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**MANUFACTURING TECHNOLOGY SUPPORT (MATES)  
Delivery Order 0002: Business Practices Assessment (BPA)  
Development**

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The University of Tennessee**

**MARCH 2008  
Final Report**

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# TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
EXECUTIVE SUMMARY .....	1
1.0 INTRODUCTION.....	2
1.1 Project Scope and Hypotheses .....	2
2.0 METHODOLOGY .....	3
2.1 RIPA Data Collection .....	3
2.2 Qualitative Data Gathering .....	4
2.3 Hypothesis 1 Research Design.....	5
2.4 Hypothesis 2 Research Design.....	5
2.5 Hypothesis 3 Research Design.....	5
2.6 Hypothesis 4 Research Design.....	5
2.7 Hypothesis 5 Research Design.....	5
2.8 Hypothesis 6 Research Design.....	5
3.0 RESULTS .....	6
3.1 Face Validity .....	6
3.2 Changes made based on the survey.....	6
3.3 Reliability based on Calculated and Consensus Score Differences .....	7
4.0 DISCUSSION .....	8
5.0 RECOMMENDATIONS AND CONCLUSIONS.....	15
5.1 Training.....	15
5.2 Application of the RIPA Assessment.....	16
5.3 Miscellaneous Observations.....	16
5.4 Future Implications and Actions .....	17
APPENDIX A: ABBREVIATIONS AND ACRONYMS.....	20
APPENDIX B: THE RIPA ASSESSMENT TOOL AND PROCESS .....	21
APPENDIX C: HISTORY AND BACKGROUND OF THE PROJECT.....	26
APPENDIX D: MRL AND RIPA QUESTIONS COMPARISON .....	31
APPENDIX E: COMPANY A VISIT SUMMARY .....	32
APPENDIX F: COMPANY C VISIT SUMMARY .....	36
APPENDIX G: COMPANY D VISIT SUMMARY .....	41
APPENDIX H: COMPANY E VISIT SUMMARY .....	46
APPENDIX I: COMPANY F VISIT SUMMARY.....	51
APPENDIX J: COMPANY G VISIT SUMMARY.....	55
APPENDIX K: WEEK 3 RIPA FIELD WORK, JULY 30 – AUG 3, 2008.....	60

## LIST OF FIGURES

<b><u>Section</u></b>	<b><u>Page</u></b>
Figure 1. UT Team Assessments for All Companies.....	10
Figure 2. Management Team Five Years Ago – All Companies .....	10
Figure 3. Consistency of Class Assessments for Company W .....	11
Figure 4. Consistency of Class Assessments for Company V .....	12
Figure 5. Variation in Companies (All Companies Visited by Class) .....	12
Figure 6. Comparison of Three Visits to Same Company Over 18 Months .....	14
Figure 7. Bias in Rating at Company G .....	18
Figure 8. Bias in Rating at Company A .....	18
Figure 9. Evaluation of Company V by Experts, Trained Participants, and Untrained Participants .....	19
Figure 10. Average Score From Companies Visited in Field Training 2007 .....	19
Figure 11. Sample RIPA Bubble Chart.....	24
Figure 12. Bubble Chart for Sample Scenario .....	25
Figure 13. Company A – Management’s Rating From Input of 27 Items (Data Index 10) .....	33
Figure 14. Company A – UT Team’s Evaluation From Consensus (Data Index 5) .....	34
Figure 15. Company A – All RIPA Evaluations (Company A Now, Company A Five Years Ago and UT Team) .....	35
Figure 16. Company C – Management’s Rating From Input of 27 Items (Data Index 10) .....	37
Figure 17. Company C – UT Team’s Evaluation From Consensus (Data Index 5) .....	38
Figure 18. Company C – All RIPA Evaluations (Company C and UT Team) .....	39
Figure 19. Company D – Management’s Nine Item Rating From Input of 27 Items (Data Index 10) ....	42
Figure 20. Company D – Evaluation – UT Team’s Evaluation From Consensus (Data Index 5) .....	43
Figure 21. Company D – All RIPA Evaluations (Company D Now, Company D Five Years Ago and UT Team) .....	44
Figure 22. Company E – Management’s Rating From Input of 27 Items (Data Index 10) .....	47
Figure 23. Company E – UT Team’s Evaluation From Consensus (Data Index 5) .....	48
Figure 24. Company E – All RIPA Evaluations (Company E Now, Company E Five Years Ago and UT Team) .....	49
Figure 25. Company F – Management Rating From Input of 27 Items (Data Index 10) .....	52
Figure 26. Company F – UT Team’s Evaluation From Consensus (Data Index 5) .....	52
Figure 27. Company F – All RIPA Evaluations (Company F Now, Company F Five Years Ago and UT Team) .....	53
Figure 28. Company G – Management’s Rating From Input of 27 Items (Data Index 10) .....	56
Figure 29. Company G – UT Team’s Evaluation From Consensus (Data Index 5) .....	57
Figure 30. All RIPA Evaluations (Company G Now, Company G Five Years Ago and UT Team) .....	58

## LIST OF TABLES

<b><u>Section</u></b>	<b><u>Page</u></b>
Table 1. Data Gathered and Relationship to Hypotheses.....	4
Table 2. Demographics of Participating Companies.....	6
Table 3. Sample From Face Validity Survey .....	7
Table 4. RIPA 27 Items for Input of Independent Assessment by Evaluators.....	22
Table 5. RIPA Nine Categories of Business Viability .....	23
Table 6. Mapping of Nine Categories Into Independent Variables.....	23
Table 7. Sample Scenario of Determining Assessment Scores.....	25

## EXECUTIVE SUMMARY

AFRL/RXM *ManTech*, the Manufacturing and Technology Division of the Air Force Research Laboratory's (AFRL) Materials and Manufacturing Directorate, is charged with understanding and facilitating successful new key technologies for the United States Air Force. In the past, this mission has primarily focused on understanding and facilitating the science behind these new technologies and the manufacturing process required for stable product availability. Success is being re-defined to include the science and technology maturation process which includes the manufacturing capability and business viability of the organizations providing these specialty products.

A process named the Rapid Industrial Preparedness Assessment (RIPA) has been created to aid AFRL/RXM *ManTech*'s technology evaluators in assessing this definition of success. The RIPA has been developed specifically for this application by the Center for Executive Education at the University of Tennessee, Knoxville at the request of the acting AFRL/RXM *ManTech* Division Chief.

**About the RIPA** - The RIPA process is designed to be a quick preliminary evaluation of a company based on readily available information from public sources, a general presentation by management, a tour of their facilities and short, often impromptu conversations with three to four front-line employees. This information is gathered and entered into a custom spreadsheet which allows multiple persons to independently enter their scores on 27 items. These scores are weighted with respect to nine categories. The evaluators then reach consensus on these nine categories that represent business viability. The data is finally represented with a plot that suggests the company's value stream, operational excellence, and financial health.

**Project Scope** - The scope of this project is to 1) validate the RIPA, 2) explore the RIPA's potential to suggest areas where a business may need to focus to improve viability and 3) to explore the interaction of the RIPA tool with the existing Manufacturing Readiness Assessment (MRA)/Technology Readiness Assessment (TRA) processes of AFRL/RXM *ManTech*. The data and reasoning for the conclusions discussed in this summary are found in the body of this report, as well as additional conclusions and findings. *Use of these summary conclusions and/or the RIPA instrument without reading the entire report is not recommended.*

**Conclusions** - The RIPA tool and processes are valid and reliable methods for accurately assessing the business condition and viability of a small company or a facility within a larger company. Trained *ManTech* personnel are able to obtain evaluations consistent with expert observers. Those experts are able to match results with persons having years of experience with a company after only a four hour RIPA evaluation. After conducting the RIPA assessment, the results for a given company can be used to 1) establish strengths and weaknesses; 2) create action plans for improvement; 3) compare companies as one tool among many in a selection process, and 4) append the knowledge based on Manufacturing Readiness Level (MRL) / Technology Readiness Level (TRL) assessments to develop a holistic picture of the risk associated with technology transfer.

**Recommendations** - Among many others discussed later in the body of this report the key recommendation of this report is that AFRL/RXM *ManTech* management should require the RIPA tool to be used consistently when 1) new companies are visited for the first time to assess potential USAF acquisition of new products requiring extensive technology transfer and 2) for all companies with on-going USAF acquisition or technology programs.

In addition to the AFRL/RXM *ManTech* specific recommendation above, the RIPA tool could be a useful tool for managers and decision makers who find assessing plants a part of their job responsibilities.

**Availability** -- Full documentation of the RIPA process, the associated spreadsheet, and report on its development and validation can be found at <http://bus.utk.edu/usaf/ripa.htm>.

## 1.0 INTRODUCTION

AFRL/RXM *ManTech* is charged with understanding and facilitating successful new key technologies for the United States Air Force. In the past, this mission has primarily focused on understanding and facilitating the science behind these new technologies. Success is being redefined to include the science and technology maturation process, manufacturing capability and business viability of the organizations providing these specialty products.

A tool has been prepared to aid AFRL/RXM *ManTech*'s technology evaluators in assessing this success. This tool is named the Rapid Industrial Preparedness Assessment (RIPA) and has been developed specifically for this application by the Center for Executive Education at the University of Tennessee, Knoxville.

The RIPA was first developed in early 2005. The tool was part of a three-week course of study designed to provide persons having a technical background with a primer on basic business principles. The introduced topics included financial evaluation, marketing, leadership, supply chain and Lean manufacturing. The RIPA was used at the conclusion of the course as a platform to tie all of these topics together. Local companies were visited and assessed during week three to provide a hands-on experience for practicing assessment and calibration of the assessors. See Appendix B for the details of the development of this tool.

The third week of the course was conducted for the second time from July 30 through August 3, 2007. During this week of the course, participants were introduced to the RIPA tool and companies were visited for practice and recalibration of the assessors.

### 1.1 Project Scope and Hypotheses

The purpose of this project is to 1) validate the RIPA process and 2) explore the RIPA process' potential to suggest where a business may need to focus to improve viability. A research team composed of Allen Pannell, Elaine Seat, and Maria Weese performed site visits to exercise the RIPA process. The results were documented and analyzed subsequent to each site visit.

The data used in this analysis was provided from the Assessors (those coming into the company and performing the RIPA) and from the company's management team (persons employed by the company being visited). A complete description of the methodology is provided in section 2.

This project tested the following hypotheses:

- *Hypothesis 1:* Outside assessors can arrive at an accurate evaluation of a company's viability using the RIPA process (Assessor and management team RIPA input).
- *Hypothesis 2:* The RIPA process can identify strengths and weaknesses for a company (Assessor, management team, and qualitative input).
- *Hypothesis 3:* Outside assessors and the company's management will arrive at similar conclusions regarding business viability.
- *Hypothesis 4:* The RIPA tool will provide the same conclusion that management interviews suggest regarding past and present states of the organization (Qualitative Study).
- *Hypothesis 5:* The RIPA tool is a valid and reliable instrument.
- *Hypothesis 6:* The RIPA tool can be used in conjunction with MRAs and TRAs.

## 2.0 METHODOLOGY

A study was designed to gather data that would provide insight into the project's hypotheses. This study collected quantitative and qualitative data for a variety of companies and gathered raw input from assessors and the management team. This data was subsequently used to evaluate the six hypotheses.

Six companies were visited by the University of Tennessee RIPA team<sup>1</sup> (UT team) specifically for this study. Two of the companies are participants in AFRL/RXM *ManTech* programs. The remaining four are from a spectrum of facilities that includes manufacturing raw materials processing plants and high-technology electronics manufacturing and design. This variety of business products and services was deliberately chosen to test the application range of the RIPA process.

Five companies were visited in the RIPA refresher training. The data from these visits are also considered. These also span a wide variety of industries and company size.

### 2.1 RIPA Data Collection

The RIPA instrument is based on input from evaluators who independently rate a company on 27 targeted items. These 27 items are weighted and provide scores on nine categories of company performance. The evaluators use these scores to subsequently arrive at a final consensus score through dialogue among the team members. This final consensus score is based on the evaluators' personal information, observation, and the score suggested from the 27 items. Thus, two sets of data for the nine categories are available: the 27 item suggested score and the nine category consensus score. Appendix B provides a detailed description of the RIPA instrument and interpretation of the graphical results.

The UT team arrived at their results by each person independently answering the 27 item set and then reaching consensus as a group on the final score for each of the nine categories. This is the intended mechanism for any team using the RIPA instrument.

The data gathering process followed this procedure:

- The prospective company was contacted and arrangements were made for a visit. They were directed to treat the visit as if the UT team was a prospective client visiting for the first time. They were asked to provide a short overview, a plant/facility tour, an opportunity for a short dialogue with their management team and brief one-on-one visits with a few shop floor workers and supervisors.
- Before the visit, the project team did an internet search for any news about the company and the company's market sector. Yahoo's financial page (free service) was viewed for financial information. In the case of private companies, other public companies in the sector were researched to arrive at assumptions of financial information.
- A half-day site visit was made to the company.
- A presentation was made by company management regarding their background, marketing strategy, products and future plans. This presentation was not prepared specially for this visit. Typically, it was one that had been used with other potential clients. We specifically requested that the participating companies NOT prepare a unique presentation for us, but that they use one they had recently used with another prospective client.
- The project team provided information regarding the purpose of this research.

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<sup>1</sup> The UT Team is the research team composed of Allen Pannell, Elaine Seat, and Maria Weese. All or a combination of these researchers visited each site and performed a RIPA.



- A tour was made through the facility.
- One-on-one visits were conducted with employees either meeting with the UT team privately for a short discussion or in impromptu chats while on the facility tour.
- The management team was asked to fill out a set of questionnaires (see Table 1). Data indexes 6, 7, 8 and 9 are data from forms the management team filled out for subsequent input into a RIPA tool analysis).
- The management team was interviewed to gather qualitative data.
- The project team completed the RIPA tool and documented their visit.

Gathering data for this study required choosing companies to visit and executing the RIPA process. In addition, other data were collected that was used to validate the process. Once the data set was gathered, it was used in multiple analyses to test the hypotheses.

The type of data gathered and its relation to the first five hypotheses is described in Table 1.

**Table 1. Data Gathered and Relationship to Hypotheses**

Data Index	Description	Hypothesis				
		1	2	3	4	5
1	Company Demographics					
2	Qualitative Interviews		X		X	
3	Assessor's responses to 27 items			X		X
4	Assessor's calculated 9 category scores					X
5	Assessor's consensus scores for 9 categories	X	X	X		X
6	Average of Management's responses to 27 items for the present day			X	X	X
7	Average of Management's responses to 9 items for the present day	X	X	X	X	X
8	Average of Management's responses to 27 items for 5 years ago			X	X	X
9	Average of Management's responses to 9 items for 5 years ago			X	X	X
10	Calculated management 9 category score for the present day	X	X	X	X	X
11	Calculated management 9 category score for 5 years ago			X	X	X

Note 1: Data indices 10 and 11 are the nine item scores as calculated from the 27 item inputs in data indexes 6 and 8

Note 2: Additional data for hypothesis 6 came from MRA/TRA data provided by AFRL/RXM *ManTech*.

## 2.2 Qualitative Data Gathering

At the conclusion of the site visit, the management team at each company was asked two open-ended questions. The purpose of these questions was to provide an open forum for information that may not have been specifically addressed during the site visit. These questions were:

- What is different from five years ago and now?
- What are your biggest challenges?

### **2.3 Hypothesis 1 Research Design**

Hypothesis 1 was tested by a comparison of data indices 5, 7 and 10. These scores were analyzed in all categories to determine if there were statistically significant differences in scores from the research team, manager's direct scoring of the nine categories and the calculated nine category scores.

### **2.4 Hypothesis 2 Research Design**

Hypothesis 2 was tested by an examination of the nine category responses of each company to identify areas of strength and weakness for that company. This analysis compared the researcher's identified areas to those identified by the management team in their scoring and qualitative interviews.

### **2.5 Hypothesis 3 Research Design**

Hypothesis 3 was tested by a comparison of the nine categories across all participating companies. The statistical analysis was compared with the qualitative data to confirm that the data represented what was told by the management team.

A second analysis compared the management team's scores regarding performance five years ago and their present day scores with their qualitative descriptions of what had changed.

### **2.6 Hypothesis 4 Research Design**

Hypothesis 4 was tested by comparing the nine category scores for the present and five years ago with the qualitative data provided by the management team.

### **2.7 Hypothesis 5 Research Design**

Hypothesis 5 states that the RIPA is a valid and reliable instrument. Validity and reliability were established by 1) evaluating face validity of the 27 items and 2) evaluating significance in calculated versus consensus scores for the nine categories.

### **2.8 Hypothesis 6 Research Design**

Hypothesis 6 was primarily accomplished through the evaluation of AFRL/RXM *ManTech* documentation on the two visits where the MRA/TRA process had been implemented.

### 3.0 RESULTS

The demographics of the companies visited by the UT team are provided in Table 2. These companies provide a broad range for testing the RIPA instrument. Detailed write-ups for each company can be found in Appendices E-J.

**Table 2. Demographics of Participating Companies**

				Market Distribution		Global Presence
Company	# Employees	\$ Annual Sales (M)	Sales per employee	Gov't	Commercial	
1	75	\$8	\$102,667	20%	80%	Y
2	290	\$69	\$237,931	75%	25%	Y
3	56	\$70	\$1,250,000	0%	100%	Y
4	61	\$45	\$737,705	0%	100%	Y
5	30	\$10	\$333,333	100%	0%	N
6	75	\$13	\$173,333	100%	0%	N

### 3.1 Face Validity

A key aspect in analyzing any measurement or assessment instrument is face validity. That concept is simply, at face value, *do experts consider the instrument does what it is intended to do*. For the RIPA instrument, five experts were surveyed to assess face validity. The experts were:

- Ed Miles, President Miles and Associates
- Dr. Ken Kirby, Professor Emeritus, University of Tennessee
- Dr. Ken Gilbert, Professor and Department Chair, University of Tennessee
- Dr. Mandyam Srinivasan, Professor, University of Tennessee
- Dr. Dan Flint, Professor, University of Tennessee

Srinivasan and Flint were contributors to the development of the instrument. They were asked to evaluate the items because of their knowledge of the purpose and intent of the instrument, in addition to their extraordinary expertise. Miles, Kirby and Gilbert were chosen as experts not involved with the development of the instrument, and because of their extraordinary expertise with company processes, organizational excellence, Lean manufacturing principles and management science.

A survey with instructions (see sample in Table 3) was sent to each expert, in addition to verbal instructions. Each expert completed the survey and the results were analyzed by the authors of this report.

### 3.2 Changes made based on the survey

While several new questions were suggested by the experts, none were selected as additional questions for three reasons:

- No suggested questions were determined to be superior to the existing questions.
- A change in just one question would theoretically require a new validation process.
- The questions as currently stated have proven to provide a valid assessment.

Based on the ratings of the questions by the experts, the weighting factors of six questions were changed relative to the scoring of the RIPA. These changes, while making common sense, did not make a statistical change to the values for eight of the nine categories. The change did increase the Customer Satisfaction category average by 0.1 in the direction needed to correct a bias that was noted in the validation process.

**Table 3. Sample From Face Validity Survey**

<b>Market Analysis</b>	<b>No</b>	<b>Minimal</b>	<b>Some</b>	<b>Strong</b>	<b>Very</b>
<i>Current and new products meet and anticipate the needs of the market place</i>	<b>Relation</b>	<b>Relation</b>	<b>What</b>	<b>Relation</b>	<b>Strong</b>
A written Marketing Plan is being implemented	1	2	3 <i>2</i>	4 <i>2</i>	5
The company has the ability to access the market of the proposed technology	1	2	3	4 <i>2</i>	5 <i>2</i>
The proposed technology fits with the current strategic plan of the organization	1 <i>1</i>	2	3	4 <i>2</i>	5 <i>1</i>
Data supports that a market exists for the proposed technology	1	2	3	4 <i>2</i>	5 <i>2</i>
The company has a focused Marketing Plan	1	2	3	4 <i>2</i>	5 <i>2</i>

Note: The survey rating scale of 1 (No Relation) to 5 (Very Strong) is shown in black with number of expert responses regarding the strength of item to the category in *Red/italics* below that rating number. For example, the item *The company has a focused Marketing Plan* received two responses for Strong Relation and two responses for Very Strong in the Market Analysis category.

### 3.3 Reliability based on Calculated and Consensus Score Differences

Reliability of the RIPA tool has been evaluated by analyzing calculated scores versus consensus and specifically input scores.

The first analysis of reliability evaluated the differences between the calculated and consensus nine item category scores of the research team.

The second analysis of reliability evaluated scores in data indices 7 and 10 and data indices 9 and 11 for significant differences in the nine category scores as calculated from the 27 items and those directly provided by the management teams.

## 4.0 DISCUSSION

All data analysis in this project must be considered qualitative. Although the RIPA generates numerical values and graphs, all conclusions, whether reported with numerical analysis, graphs or otherwise, must be considered to have come from a qualitative analysis due to the small sample size and complexity of variables.

**Thus, the primary limitation of this study is the inability to put probabilities on statements of conclusions.**

Hypothesis 1: *Outside assessors can arrive at an accurate evaluation of a company's viability using the RIPA process. (Assessor and management team RIPA input)*

This hypothesis has been shown to be true. Demonstration of this hypothesis was seen in three different methods:

- The success of UT team (in a four hour visit) to match an expert analysis of two companies where the expert has over five years experience with each company and access to all relevant data.
- The success of UT team's ability to mimic management assessments during the validation site visits.
- The success of AFRL/RXM *ManTech* personnel being able to assess companies during the RIPA training courses.
- Variability is demonstrated across all of the companies visited and accurately portrayed by the UT team, AFRL/RXM *ManTech* teams, and the management teams.

In *Method a*, facilities were visited where one of the UT evaluators had extensive experience with the plant. Through prior work at the corporate office, initial assessments over the last five years of the facilities, personal knowledge of the plant leadership and access to financial and other relevant data, the expert UT evaluator could accurately assess the facility using the RIPA tool. This evaluator refrained from interacting in the rating of the facilities by the other two UT evaluators during the four hour standard RIPA visit and research.

*Method a* provides the most striking evidence for substantiation of hypothesis 1. The graphs provided in Figure 18 and Figure 21 summarize the data that support this hypothesis. In both of these cases, Figure 18 and Figure 21 illustrate the ability of the evaluators to match almost exactly the expert's analysis, even though the perception of management at each location about their own situation was quite varied. In essence, the RIPA tool in capable hands with the standard agenda was able to replicate more than five years of intimate knowledge.

*Method b* is a more approximate measure of the RIPA process' accuracy. In each case of the site visits, management was asked to rate their company on the 27 questions and their scores were averaged to create a final score. Note that management did not take the time to reach consensus on their answers. While the UT team believe that management answers would have some positive bias in general, it makes sense that no one would have a better understanding of a company than senior management themselves. Also it is worth noting that some of the information the evaluators used in making their ratings, were of course provided by management. Every effort is made to validate the information through observation, internet research and employee interviews. The expectation was that the evaluators would have answers close to management with variation expected due to potential management bias and evaluator lack of information. In all six companies, the UT team and management ratings were similar enough to suggest the RIPA process to be a valid instrument. In five of the six cases, management had ratings on the RIPA scale that were more favorable than those of the evaluators, perhaps an indication of management bias. The individual bubble graphs and bar charts for each company are provided in the appendices. Due to the

sample size being small in statistical terms, comparisons are made graphically rather than numerically in these cases.

*Method c* uses the RIPA assessments from the third AFRL/RXM *ManTech* training class to evaluate the ability of the typical end user to conduct accurate assessments.

*Method c* has been conducted three different times since the creation of the RIPA instrument. The first two times were associated with AFRL/RXM *ManTech* training and were prior to the commission of the research effort. The third effort was a review session for many who had been to the training and a few attendees that had not. The class was conducted during the research project and the class data included in this study. While the results of the other two efforts are not included in this study directly, they were consistent with those discussed here. AFRL/RXM *ManTech* personnel that attended the one week assessment practice event were placed on teams for each of five different plant tours and assessments. The teams were generally assigned at random and rotated on a daily basis. One exception occurred when none of the members had been to training. (The results from this untrained team are discussed in the recommendations.)

Figure 3 and Figure 4 illustrate the results for the class visits to two companies. For most visits, Figure 3 is indicative of the results. That is, the teams obtained results consistent with the instructors (experts). Again, analysis is performed graphically. On some visits, there would be a difference of opinion by one team as noted in Figure 4. In these cases, group discussion of the differences would serve as continued calibration and training for the *ManTech* personnel.

While on some visits class members would debate the exact ratings of each company, the final graph and relative position of each company to the other was well supported by all student groups.

*Method d* places the results for all of the companies on a single chart for the management team and for the UT team.

Figure 1, Figure 2, and Figure 5 illustrate the RIPA process's capability to identify the variation in companies visited. This identification of variation in companies visited also serves to support the ability of the process to distinguish one company from another.

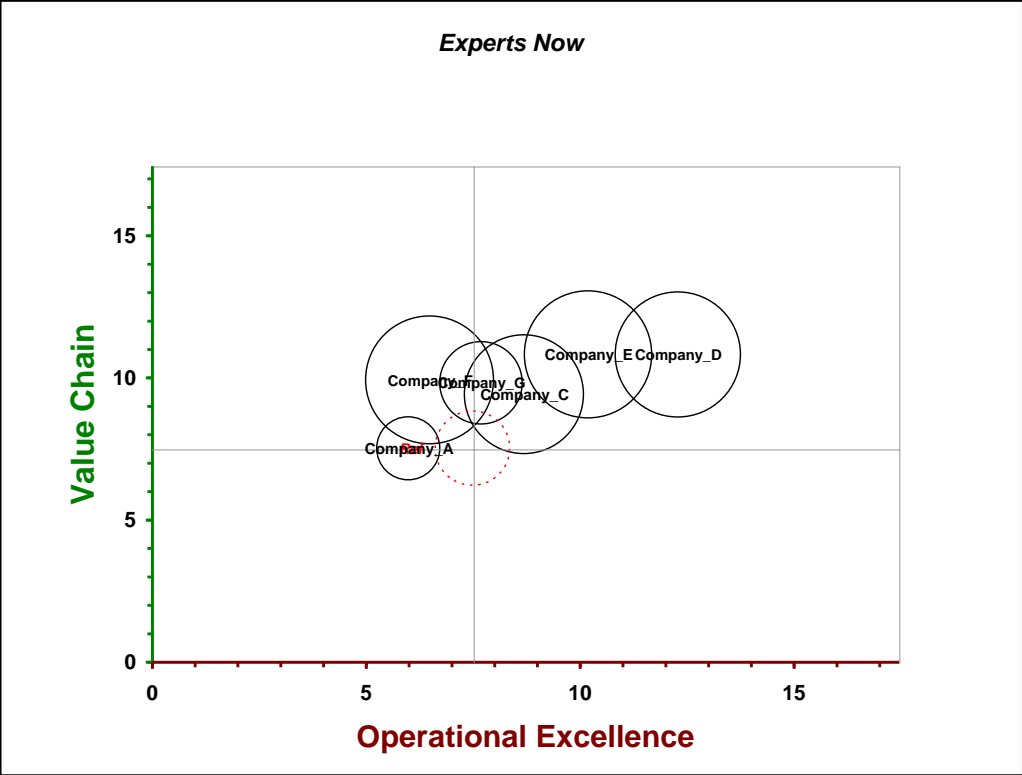


Figure 1. UT Team Assessments for All Companies



Figure 2. Management Team Five Years Ago – All Companies

Conclusion for Hypothesis 1: The data support the hypothesis and it is the opinion of the report writers that the RIPA instrument and process can and does result in an accurate assessment of a companies current business strengths and weaknesses with respect to the RIPA model. The instrument has been successfully used in a variety of industries, size of companies and with teams with varying skills, backgrounds and experiences.

**NOTE:** the RIPA process could not likely have identified solutions to any deficiencies, but certainly could identify where those deficiencies lie.

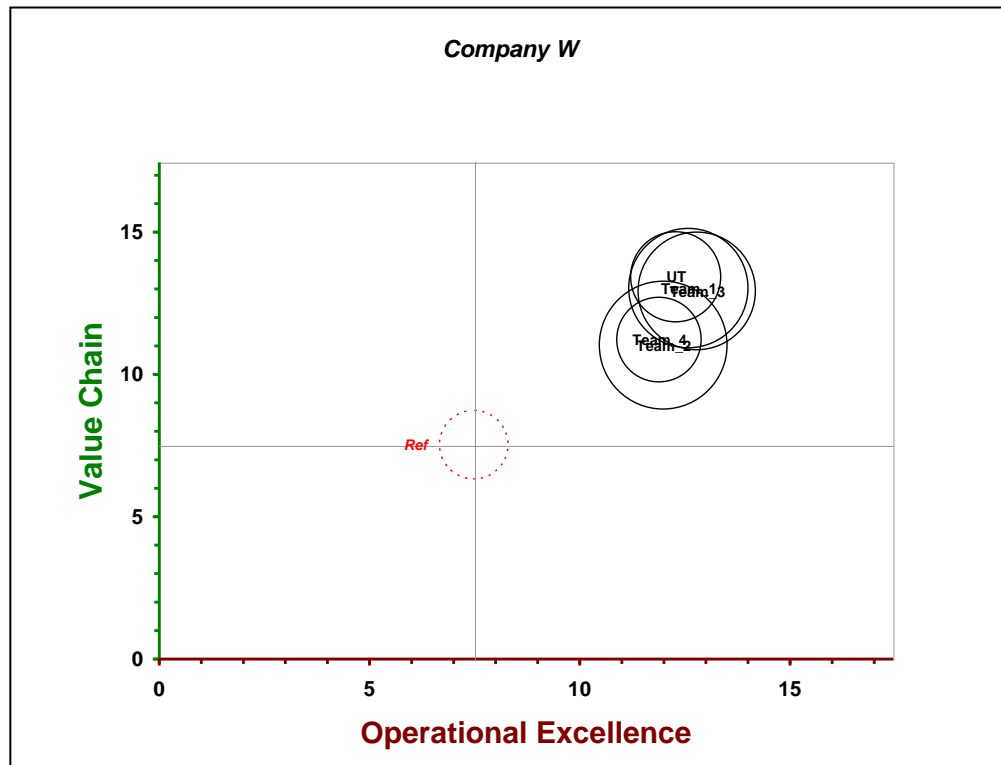


Figure 3. Consistency of Class Assessments for Company W



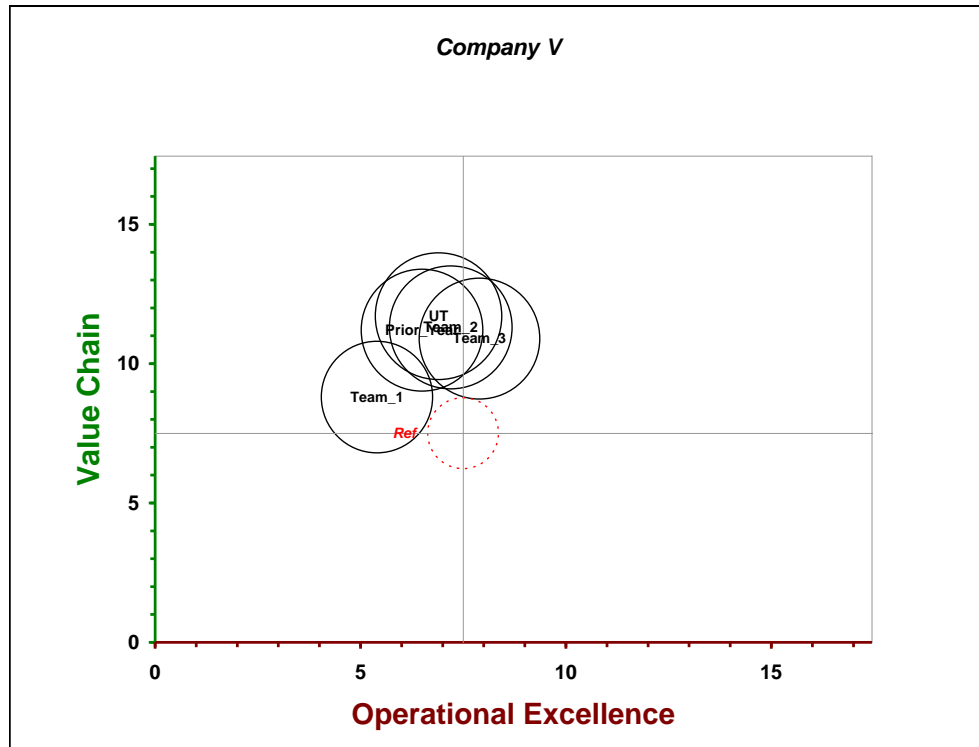


Figure 4. Consistency of Class Assessments for Company V

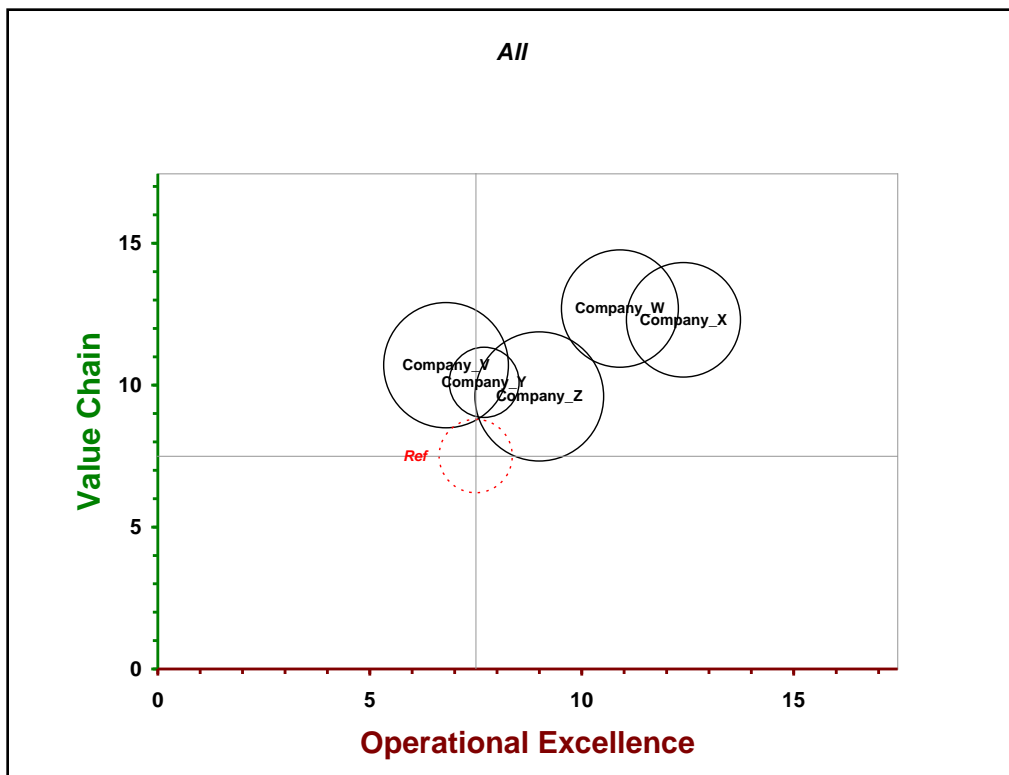


Figure 5. Variation in Companies (All Companies Visited by Class)

Hypothesis 2: The RIPA process can identify strengths and weaknesses for a company. (Assessor, management team, and qualitative input.)

This hypothesis has been shown to be true. As seen in the company write-ups (Appendices E through J), the management and UT team assessments are similar as the bubbles typically fall in the same quadrants.<sup>2</sup> The qualitative comments from management support their strengths. In particular, the nine categories show the same level of score between all assessments.

In addition, although there is not significant difference between the UT and management teams for a particular company, there is difference between companies. This suggests the RIPA process is capable of identifying differences in performance among the nine categories.

Hypothesis 3: Outside assessors and the company's management will arrive at similar conclusions regarding business viability.

This hypothesis has been shown to be true. From comparison of the UT team and Management team RIPA evaluations, there is not significant difference between the scores (See Figure 15, Figure 18, Figure 21, Figure 24, Figure 27, and Figure 30). The bubbles are generally within the same quadrant, and thus suggest the same strengths and weaknesses.

Hypothesis 4: The RIPA tool will provide the same conclusion that management interviews suggest regarding past and present states of the organization (qualitative study)

This hypothesis has been shown to be true. Management comments about their company's strengths and weaknesses five years ago and the present follow the RIPA graphs. For instance, company C and D both referred to improvements in using data to drive change and improved management. For both of these companies, the trend was toward improved Operational Excellence and Value Stream as described in the management comments. (See Figure 18 and Figure 21)

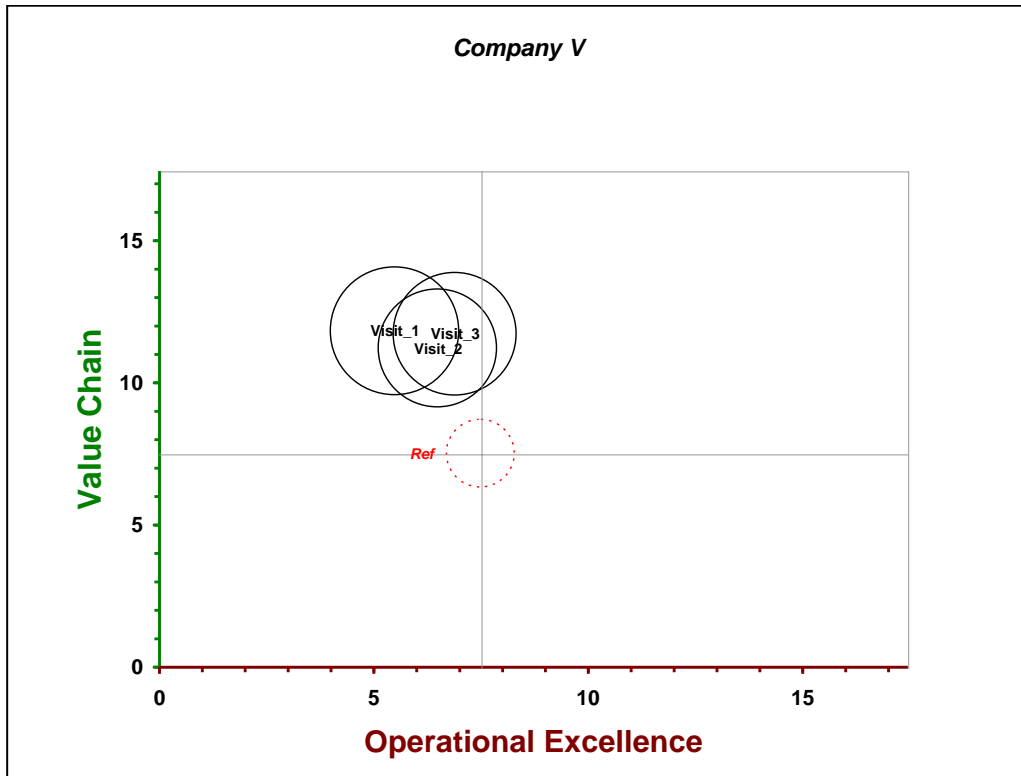
Hypothesis 5: The RIPA tool is a valid and reliable instrument.

This hypothesis has been shown to be true. Demonstration of this hypothesis can be seen in three different methods;

- The analysis of the accuracy of the instrument for Hypothesis 1 is also supportive of this hypothesis. That is, for an instrument to be valid and reliable, it must by definition be accurate. It must also prove to be useable across differing situations, companies and users. All of these attributes are shown to be true in the Hypothesis 1 discussion.
- The face validity study. See the face validity discussion in Section 3.
- For an instrument/process to be reliable, it must be able to be replicated over time. For example, one company was visited in all three training events, including the one-week program done in conjunction with this validation process. The same UT trainers visited this company all three times, while each time most of the students were different. In the judgment of the UT experts, no significant change occurred during the two year time frame of visiting this company. Each visit was scored independently by the experts (although prior knowledge exists) and the scores of the students were certainly independent since new students were involved each time. Figure 6 below shows how consistent the application of the instrument was from class to class and for the experts each time.

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<sup>2</sup> See Appendix B for an explanation of the RIPA assessment process and the interpretation of the graphical bubble charts.



**Figure 6. Comparison of Three Visits to Same Company Over 18 Months**

Hypothesis 6: The RIPA tool can be used in conjunction with MRAs and TRAs.

Hypothesis 6 is validated from a comparison of the MRA/TRA data for two of the companies with the RIPA assessments for those companies. All inferences from the RIPA/MRA/TRA support one another without contradiction.

The key implications of this hypothesis are highlighted in Section 5: Recommendations and Conclusions under the “Where the RIPA assessment fits in the evaluation process category.”

Appendix C provides a comparison of the RIPA questions with the MRL questions.

## 5.0 RECOMMENDATIONS AND CONCLUSIONS

The RIPA tool proved to be a valid and reliable instrument. An analysis of the entire collected data set shows many consistencies that suggest the instrument is a reliable general measure of a company's viability. Certainly, any business transaction must be based on full due diligence and detailed analysis, but the RIPA can suggest a starting place for evaluating a company with respect to overall business viability.

The following conclusions and recommendations have resulted from this project.

Consistent application of the RIPA process has value:

- When new companies are visited for the first time to assess potential participation in USAF research, development and acquisition programs.
- With all companies where the USAF has on-going research, development and acquisition programs.

### 5.1 Training

New AFRL/RXM *ManTech* personnel should receive training on the RIPA tool before participating or leading an assessment team. This training would most likely involve a subset of the following, depending on the person's background, and is recommended to be developed using the knowledge gained by this research project and explained below:

- With proper training, AFRL/RXM *ManTech* personnel successfully used the RIPA. From the cross section of backgrounds in the training program that were supervised during the field work portion of the training course, it is evident that persons with a background in technology evaluation can learn the basics listed in the nine categories of the RIPA adequately to use the instrument.
- On-going training is required for a uniform use of this instrument. During week three of the training course, AFRL/RXM *ManTech* personnel that had been trained in the previous year made site visits in teams to several companies. At the conclusion of the visit, each team completed the RIPA process and presented their results to the entire group. There was substantial difference between the team evaluations after the first site visit, but the teams became more calibrated and consistent with each visit and subsequent discussion. This technique of assessment and then comparison of observation and rating is an established technique for training and calibrating expert observers.
- All program managers are recommended to participate in at least two RIPA events annually to maintain calibration and expertise. Managers could participate on teams doing live assessments and/or practice assessments could be arranged as they were during this research project.
- The third week of the training course was offered in 2006 and then a refresher course in 2007. In the 2007 class, there were participants who had not been to week one and two, but were invited to participate in the field work. These participants had similar backgrounds to the trained participants, but were initially placed in a team together so that the research team could evaluate the value of having the full training course. The RIPA results from this team were significantly skewed from the teams of experts and trained participants (See Figure 9). Thus, training in all nine aspects of business viability and calibration of evaluation with field work is required for accurate and calibrated performance of a RIPA.

Training for conducting consistent RIPA requires:

- Read appropriate sections in the RIPA training manuals.
- Attend MRA/TRA training.
- Serve as an observer on at least one RIPA.
- Attend public seminars on specific topics related to RIPA.
- Participate as a RIPA team member on the first live assessment rather than as a leader.

## 5.2 Application of the RIPA

Personal impacts on accurate application (personal bias) were observed.

- Bias was observed in the assessment of two Companies. On two site visits, the UT team was accompanied by persons closely associated with the companies being evaluated. The UT team and these persons independently completed the RIPA (see Figure 7 and Figure 8 where their circle is identified as the *Helpers*). In both cases, bias was demonstrated by the team with a personal interest in the success of the company. *It is recommended that independent observers conduct a RIPA to avoid bias.*
- *Interviews with a variety of persons in the company is crucial.* The UT team discovered that management tends to be more positive about performance than perhaps is accurate. In interviewing a range of persons, management's views were sometimes supported, but often we learned the extent to which the workforce was onboard with the implementation of lean, issues about workforce quality, and confidence in the company's ability to proceed were not the same. These interviews, coupled with the tour, provided additional information that was helpful in reaching consensus scores.

Where the RIPA fits in the evaluation process:

- *Companies can be compared via the RIPA.* (reference individual company write-ups in Appendices E through J). The companies visited in the training class provided a range of capabilities and maturity in their business processes. These differences and variety were apparent in the RIPA graph of all companies plotted on a single chart (see Figure 10). This variety demonstrates the instrument's ability to discern differences in company viability.
- *The RIPA tool can not be used to determine whether or not to do business with a company.* The RIPA merely suggests areas that the company may need to focus resources to improve business viability. Due diligence and further exploration is always required to determine the exact nature of strengths and weaknesses.
- *The RIPA tool can be used in conjunction with MRAs and TRAs.* The RIPA provides additional information at the company level regarding strengths and weaknesses. The RIPA provided information on variables independent from those in the MRAs and TRAs. The RIPA complements the specific, detailed manufacturing and technology assessment by providing information about the company's viability in providing a business environment for success of the specific product.

## 5.3 Miscellaneous Observations

- In the case of observed, significant improvement of a company (both self-reported and expert observation in the case of Company B and Company C), leadership was always determined to be the primary factor which drove improvement. For example, Company F attributes their improvement to strong leadership in fiscal matters, and Company E attributed their improvement

to a complete change of management. *Thus, company leadership must be strongly considered in predicting the ability to improve viability.*

- During the company visits made by the UT team, management provided data for both the 27 items and the nine categories for their company for both the present state and five years ago. Statistically significant differences were found between the final results from these two methods, with the input of the 27 items more closely aligning with the evaluation from the UT team. The UT team believes that the nine categories are too general, while the 27 items are specific and identify behaviors. This specificity leads to more calibrated results. *Thus, the RIPA can not be short-cut to just answer the nine categories.*
- AFRL/RXM *ManTech* should resist the natural temptation by those using the RIPA to make changes and improvements to the RIPA process. The process and instrument have now been validated and shown to perform well at its intended purpose. Any changes will likely yield only a small improvement (if any at all) and ultimately lead to an instrument that is no longer valid and likely more complex.
- The RIPA process is a useful tool for managers and decision makers whose duties include the assessment of manufacturing plants to accomplish tasks for the USAF.

#### **5.4 Future Implications and Actions**

The RIPA has proved to be a valuable tool. It encourages program managers who are considering company capabilities to look beyond only that with which they are familiar. The tool, when used in conjunction with the detailed assessments of manufacturing and technology readiness, can provide insights about the business foundation that underpins the specific program of interest to the USAF.

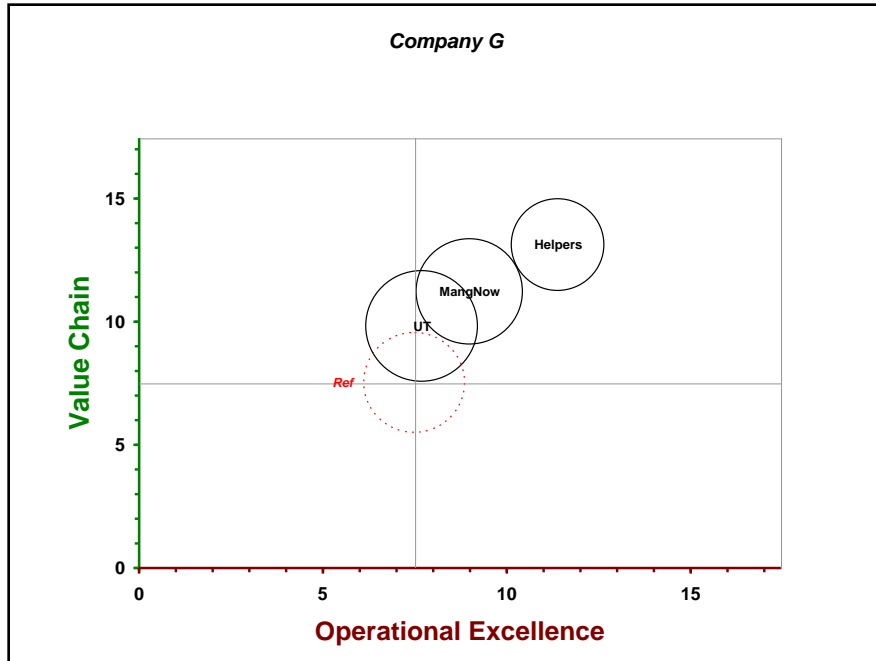
However, gauging the RIPA's ability to predict viability over time will be difficult. A true longitudinal study would:

- Evaluate a company now and predict what should be done to improve viability.
- Evaluate the company in the future and assess the extent to which the predicted improvements were carried out and made a difference.

This technique ignores synergistic effects, market impacts and the myriad of forces that shape a company's success.

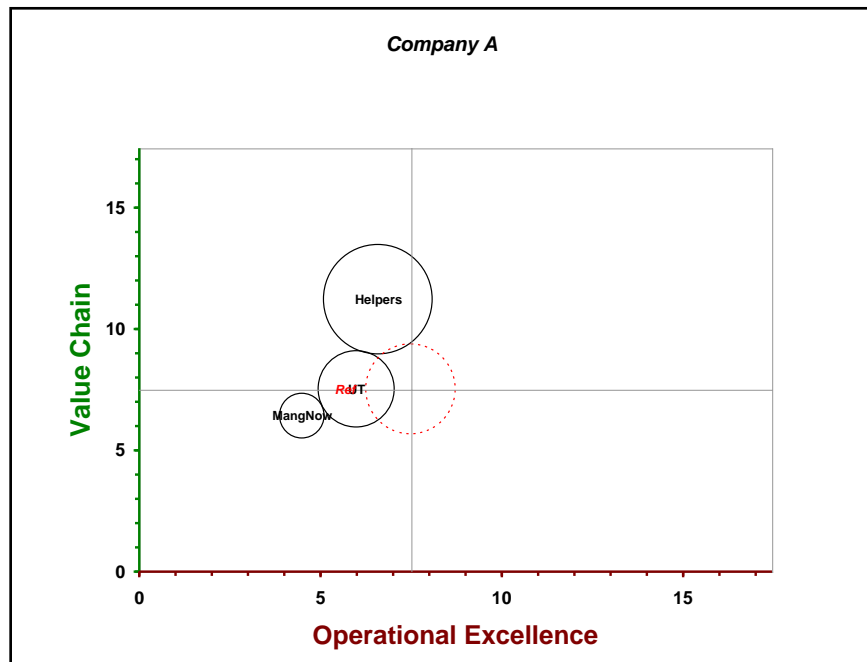
Another study to evaluate the RIPA's effectiveness would randomly choose companies to have the RIPA performed. The results would then be used by the company in future planning based on the evaluation of current capabilities. However, it is unproductive and expensive to only use the tool on specific companies to see if those with out RIPA information are less successful. Thus, the test subjects will never be available for a statistical study of effectiveness. In addition for those companies purposefully not selected for a RIPA, not providing knowledge gleaned from this type of evaluation in the name of research would be unethical.

The RIPA effectiveness is recommended to be measured qualitatively through anecdotal evidence provided by program managers. This evaluation will be dependent on the RIPA being used with other assessment tools required by program managers.



**Figure 7. Bias in Rating at Company G**

Note: The Helpers circle is the team of untrained participants. The other circles are from the UT team, and the company management team.



**Figure 8. Bias in Rating at Company A**

Note: The Helpers circle is the team of untrained participants. The other circles are from the UT team, and the company management team.

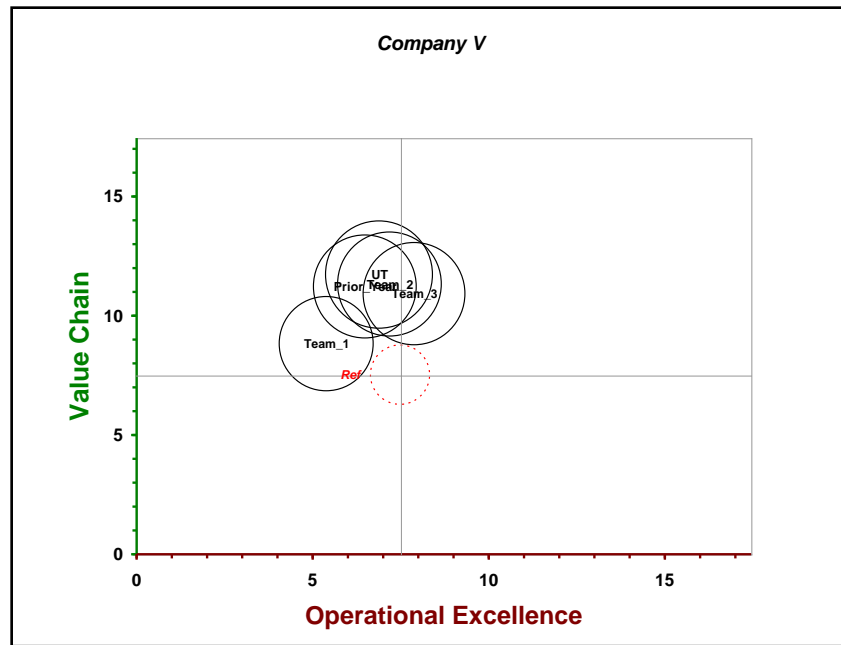


Figure 9. Evaluation of Company V by Experts, Trained Participants, and Untrained Participants

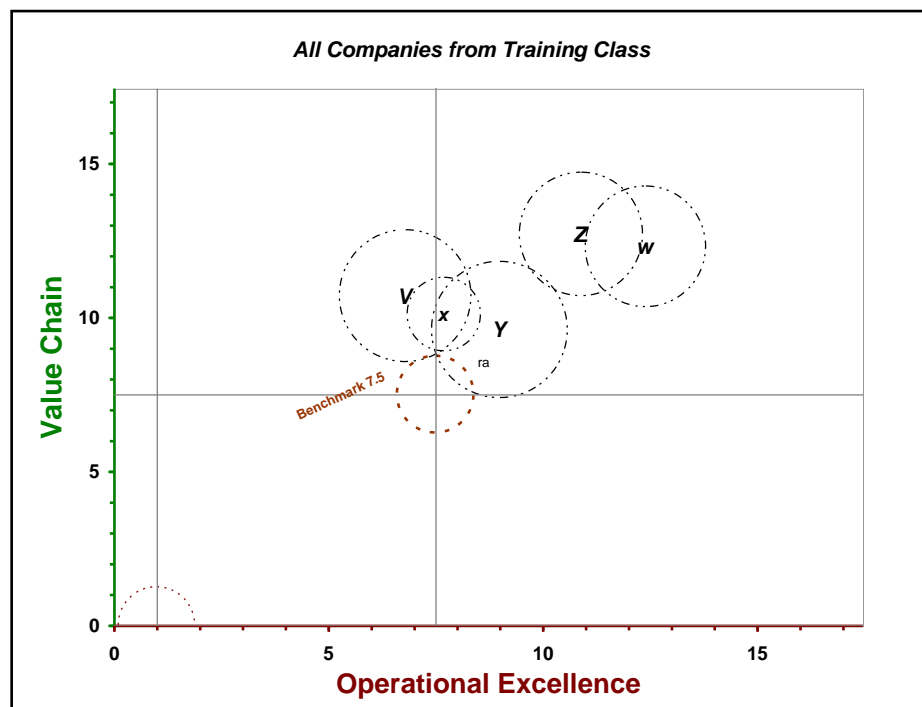


Figure 10. Average Score From Companies Visited in Field Training 2007



## **APPENDIX A: ABBREVIATIONS AND ACRONYMS**

AFRL/RXM	Air Force Research Laboratory, Materials and Manufacturing Directorate
BPA	Business Practices Assessment
ManTech	Manufacturing and Technology Division of AFRL/RXM
MRA	Manufacturing Readiness Assessment
MRL	Manufacturing Readiness Level
MRO	Maintenance, Repair, and Overhaul
MRP	Material Requirements Planning
NIST	National Institute of Standards and Technology
RIPA	Rapid Industrial Preparedness Assessment
RPA	Rapid Plant Assessment
SYMLOG	Systematic Multiple Level Observation of Groups
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
USAF	United States Air Force
WIP	Work-in-Progress

## APPENDIX B: THE RIPA ASSESSMENT TOOL AND PROCESS

### The Rapid Industrial Preparedness Assessment (RIPA)

The RIPA is a process for assessing business viability. It is intended to be used during both formal and informal site visits and provides a format for observing standard practices and asking targeted questions about all areas of the company.

The components of the RIPA are:

- Advance preparation through an internet search on the company, news about the company's business sector, any news about the company and financial information commonly available from Yahoo or Google.
- A site visit to the participating company.
- General information about the company (typically from a generic management presentation).
- A tour through the facility.
- Casual conversation with a few employees from across the company about *how it is to work there* and *what they would change*.
- Use of the RIPA Excel spreadsheet to establish a baseline assessment of business viability.

### The RIPA Tool

The RIPA tool is an excel spreadsheet with a customized interface. It allows the user to enter the company name and evaluators' names, and then a unique spreadsheet is automatically generated to be used to assess the company on that visit.

After the site visit, the evaluators independently score the company on 27 targeted items. These items are listed in Table 4. These 27 items provide scores on the nine main categories listed in Table 5. The 27 items are weighted to have a primary, secondary or tertiary effect on the nine main categories.

The nine main categories are grouped into three independent variables: Financial, Value Stream, and Operational Excellence. The mapping of the nine categories into the independent variables is provided in Table 6.

After the evaluators have entered their independent rating on each of the 27 items, an average score is calculated for each of the nine items from this aggregated input. The assessment team then uses this suggested score for each of the nine categories to discuss and reach a consensus score for the individual category. The team is encouraged to discuss what they have discovered in their preliminary preparation, observation during the visit and any other knowledge they might have of the company and this business sector to arrive at a consensus score.

**Table 4. RIPA 27 Items for Input of Independent Assessment by Evaluators**

<b>Item No</b>	<b>Targeted Item</b>
1	Workplace design supports effective process flow
2	A written Marketing Plan is being implemented
3	Constraints are being managed in key processes
4	Customer contact employees are empowered to resolve problems appropriately
5	Work Cells are utilized where appropriate
6	Customer satisfaction data guides the quality improvement efforts
7	Customer satisfaction measures are well communicated across organization.
8	Employees are empowered to take necessary action to improve processes
9	Evidence exists that the company has or could obtain adequate capital when necessary
10	Financial performance exceeds that of competitors
11	Established vision, mission, values, goals, and objectives are understood at all levels
12	Key processes are being continuously improved to meet stakeholders needs
13	Leadership behavior is consistent with stated values
14	Partner relationships are built with key suppliers and customers
15	Process cycle time is being minimized in key business processes
16	Relevant information is openly shared with key suppliers
17	Safety is an obvious priority for the organization
18	Simple statistical tools are used effectively across the organization to achieve performance improvement.
19	The company has adequate Cash flow to sustain operations for at least one year
20	The company has the ability to access the market of the proposed technology
21	The entire Value Chain is managed as a key process
22	The organization systematically benchmarks against its competition (or against best in class)
23	The proposed technology fits with the current strategic plan of the organization
24	The use of Lean tools is extensive
25	Trained internal continuous improvement champions are working in the organization
26	Data supports that a market exists for the proposed technology
27	A Problem Solving methodology is actively used by all employees

**Table 5. RIPA Nine Categories of Business Viability**

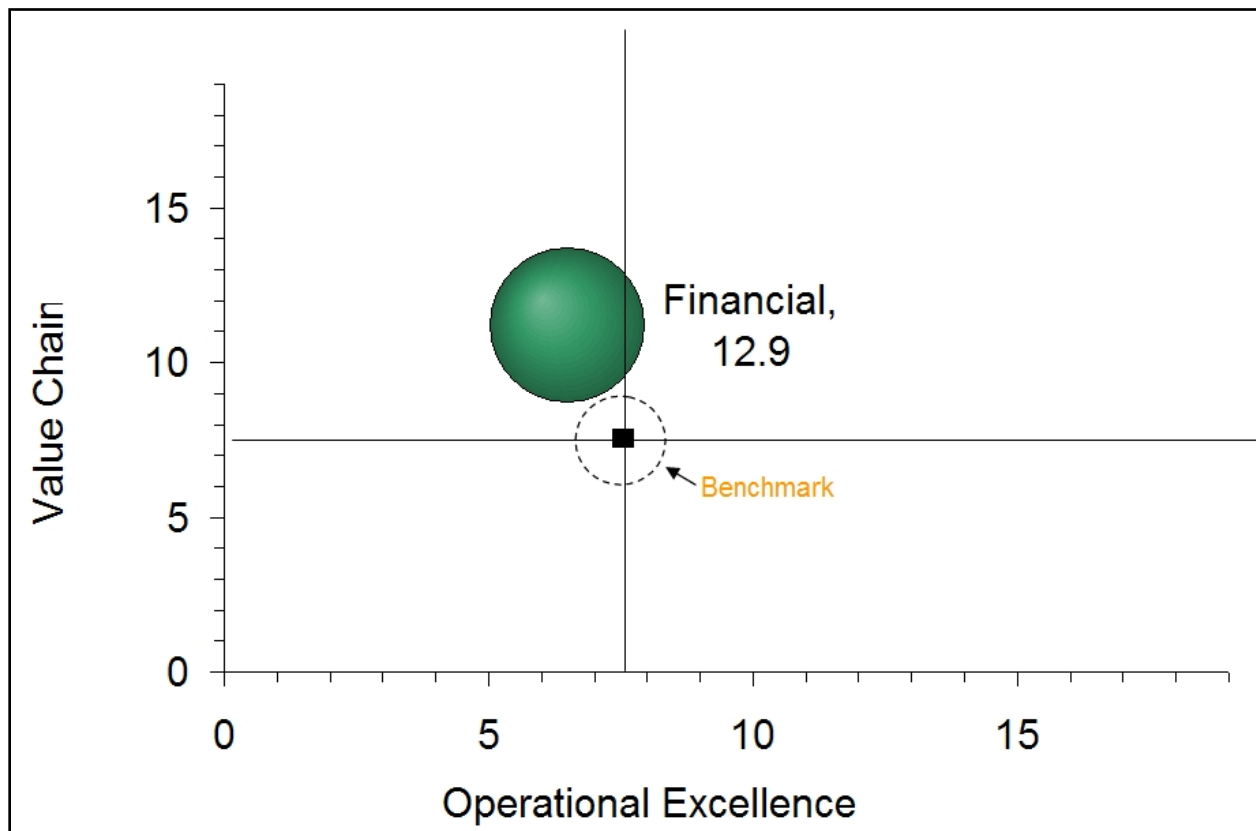
<b>Category Number</b>	<b>Category Title</b>
1	Market Analysis
2	Supply Chain
3	Customer Satisfaction
4	Leadership
5	Quality
6	Lean Operations
7	Profit
8	Cash Flow
9	Capital

**Table 6. Mapping of Nine Categories into Independent Variables**

<b>Independent Variable</b>	<b>Category</b>
Value Chain	Market Analysis
	Supply Chain
	Customer Satisfaction
Operational Excellence	Leadership
	Quality
	Lean Operations
Financial	Profit
	Cash Flow
	Capital

The consensus scores of the three categories are then summed to reach the independent variable score. The three independent variables are represented on a graph, where financial data is plotted as a circle at x and y coordinates where Operational Excellence is the x-axis and Value Stream is the y-axis. A sample bubble chart is provided in Figure 11. The size of the bubble represents the financial score. The larger the bubble the greater the estimated financial viability.

The RIPA bubble chart provides a graphical representation of the viability of a company. Scoring for all three constructs (Value Chain, Operational Excellence, and Financial) has a range of 0 to 15. The circle suggests the financial viability with the benchmark circle simply providing a reference for a score of 7.5. While there is no absolute scoring that correlates to an action, the relative size and position of the bubble suggests a company's viability in the three constructs.



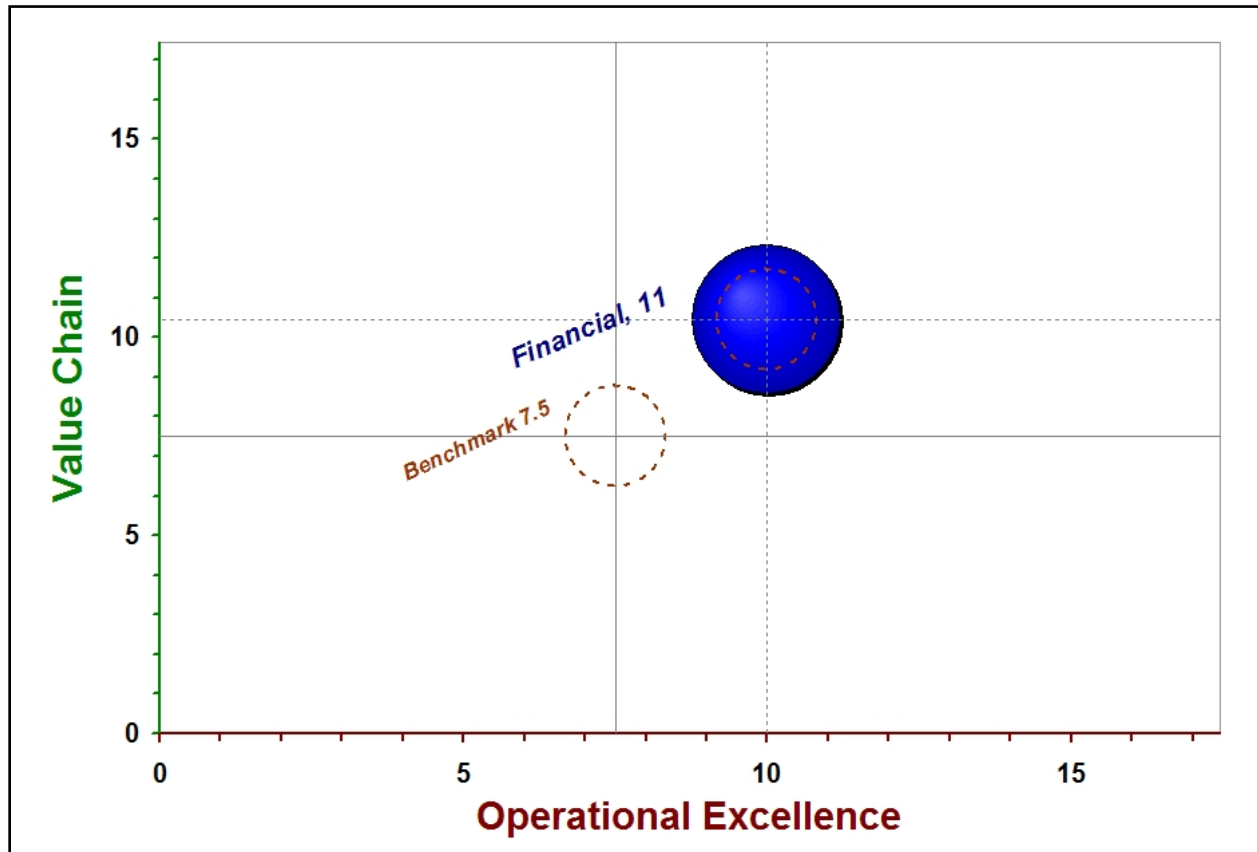
**Figure 11. Sample RIPA Bubble Chart**

#### **Sample Scenario:**

A team enters their individual rating for the 27 items into the RIPA spreadsheet for Company Q. This input generates weighted average scores as shown. During the tour, it appeared that the company has a good foundation in lean operations. However, one of the team members has followed this company for an extended time, and knows that although Lean is in place now, it is a new way of thinking for this company. The team decides to lower the scores for quality, supply chain, and Lean based on their discussion and re-evaluation. Table 7 provides sample data for this scenario. Figure 12 provides the bubble chart for this scenario.

**Table 7. Sample Scenario of Determining Assessment Scores**

Independent Variable	Category	Calculated Average	Consensus Score	Independent Variable Score
Value Chain				10.45
	Market Analysis	3.2	3.2	
	Supply Chain	4.1	3.75	
	Customer Satisfaction	3.5	3.5	
Operational Excellence				10.0
	Leadership	3.5	3.5	
	Quality	4.2	3.5	
	Lean Operations	4.5	3	
Financial				11.0
	Profit	4.2	4.2	
	Cash Flow	3.3	3.3	
	Capital	3.5	3.5	



**Figure 12. Bubble Chart of Sample Scenario**

## **APPENDIX C: HISTORY AND BACKGROUND OF THE PROJECT**

### ***RIPA Origins***

The Rapid Industrial Plant Assessment was developed by the University of Tennessee at the request of Bill Russell – Chief of the Electronics Branch for the Air Force Research Lab, Materials and Manufacturing Directorate. Its original intent was to serve as a tool to reinforce training of program managers in the areas of Finance, Marketing and Operational Excellence. This training was developed to enhance the skills of technical associates in areas of business fundamentals. The main goal was to open their eyes to issues beyond technical ones and to assist in evaluating risk related to technology transfer from the Air Force to the private sector. Past experience had shown that business readiness (or lack thereof) was a key factor in unsuccessful technology transfers as much as, or more so than technical issues.

The original instrument was fashioned based on the following elements;

- The Rapid Plant Assessment (RPA) utilized in the University of Tennessee Aerospace MBA program.
- The specifications and objectives stated for the initial project.
- The experience of the University of Tennessee staff who developed it.
- The Malcom Baldrige Award criteria.
- SYMLOG, a survey instrument developed for team building.

Each of the above elements are discussed and referenced below.

### ***Original Specifications***

The key summary of objectives is as follows, based on the actual training:

- Utilize the RIPA as a tool to understand the stability of the company, its progress with lean, and the strengths and weaknesses that may affect the probability of success for the technology transition.
- Understand how to determine whether a market exists or will exist for a particular technology or product (specifically, assess whether a business plan exists for transitioning a new technology into an existing or new product).
- Understand what types of financial information must be gathered to ascertain the financial strength of an organization.
- Accurately interpret the financial information gathered to determine an organization's financial stability.
- Understand what financial resources are necessary to bring a new technology to production.
- Better understanding of the implications of the supply chain on the well being and future viability of an organization.
- Understand how Lean and Six Sigma impact an organization and an organization's progress on the Continuous Improvement journey can be observed.
- Understand what type of assessment team should be assembled to do the RIPA, financial analysis, and any other activities deemed necessary.

### ***Rapid Plant Assessment***

The Rapid Plant Assessment (RPA) was designed by Gene Goodsen an adjunct professor in Operations Management at the University of Michigan to assist managers, consultants and students in performing a rapid evaluation of the state of their operation. The purpose of the RPA is to get an accurate snapshot of a company from a short (30 minute) tour (often this is all a competitor will allow). "With an educated eye, one could discern a plant's strengths and weaknesses accurately"(Goodsen). The information the RPA has provided has influenced activities and decisions ranging from benchmarking to competitor analysis to strategic acquisitions. The RPA results of a tour are available in a day or less whereas most rating systems would take weeks. The RPA also helps to judge the level of Lean in an operation, prioritize the targets of opportunity and facilitate improvements. The RPA assesses a plant in the following 11 categories: Customer satisfaction, Safety and Environment, Visual Management Deployment, Scheduling System, Product Flow, Inventory and WIP Levels, People teamwork and Skill Level, Equipment and Tooling State, Ability to Manage Complexity and Variability, Supply Chain Integration and Quality System Deployment. Each of these categories is rated on a 1, 3, 5, 7, 9, 11 scale where 1 is Poor and 11 is Best in Class and only one company in each industry should receive this rating.

- Customer Satisfaction and Customer ratings, quality certifications and ratings, warranty and product liability costs, employee knowledge of external and internal customer requirements, visitor materials and welcome, market share, rate of new product introduction and acceptance.
- Safety, Environment, Cleanliness and Order: Safety and environment record, place for everything and everything in its place, cleanliness of operations, exterior and interior doors, equipment, spills, leaks, noise, lighting, paint, dust, air quality, employee dress, restroom conditions, desks and workbench order and cleanliness degree of spiffing for visitors (negative), inventory order, material flow order and cleanliness, color and other coding for safety and order.
- Visual Management Deployment: Operations mission and performance objectives visible, visibility of labeling and coding of product lines, inventory, equipment and tooling, color coding and differentiation, visibility of customer identification and ratings, visibility of charts tracking operations and team safety, quality and productivity, control room showing status of total operation, customer order and order fulfillment visibility, Kanban deployment, inventory count can be made visually, machines and tool labeling, costs, preventive maintenance visibility, product displays, audit results visible.
- Scheduling System: Degree of scheduling to customer order, order process efficiency, product line scheduling at single point, scheduling buckets (each order, hourly, daily, weekly, monthly), supplier scheduling and delivery, replenishment versus order fulfillment, computer scheduling versus Kanban, pull versus push systems, flow time efficiencies, back room costs of scheduling, MRP costs, data entry costs.
- Product and Material Flows: Product line versus shop layout, rolling carts pulled by tractors or by hand or conveyors versus forklifts, travel distances between processes, material movement responsibility (process owned or separate material staff, container one size, containers designed for parts families, single versus multiple docks to minimize material travel, space utilization, goals for space use reduction).
- Inventory and WIP Levels: WIP levels at each process, WIP in transit in plan, separate stores versus line side storage, number of inventory storage areas, finished product levels, total inventory to sales ratio, process cycle time to flow time ratios, accountability of inventory, WIP movement triggered by computer, material department or next process, theoretical versus actual flow times.
- People teamwork, skill level: Team problem solving capability and history, employee willingness to talk about customers, products and company, uniformity of dress, communications



and recognition environment, sales per employee, team meeting areas and performance charts, training investments, educational support, benefit package and costs, unionization activity, workforce-management relationship, community support, company-supported activities (picnics, open houses, sports teams), local involvement, employee knowledge of support and of customers and business, work instructions standards.

- **Equipment and Tooling State:** Preventative maintenance system, setup change times, integrated go/no go quality checks, machine performance data availability, knowledge and utilization of bottleneck processes, process control capability, total asset utilization, operator routine maintenance, maintenance staff and teams, MRO replenishment efficiency, tool and fixture orderliness, cleanliness and storage location, equipment improvement policy, equipment technology strategy.
- **Ability to Manage Complexity and Variability:** Use of common parts, processes, and procedures prototype process, paper transactions required on floor, keyboard entries versus bar coding, back room paperwork and computer transactions costs, matching of data collected with data needed, simplicity and clarity of operations layout, indirect to direct labor ratio, support staff to total workforce ratio, overhead cost ratios, commonality of tooling and fixturing, commonality of equipment and tools, commonality of support software and applications programs across the operation among sister plants, equipment efficiencies, ability to handle variable demand, ability to eliminate controllable variations, ability to smooth demand, ability to handle supply chain, number of suppliers.
- **Supply Chain Integration:** Number of suppliers, supplier release system(from inventory levels or customer order), supplier certification, sourcing policies -short-term or long-term, supplier quality ratings, delivery, and productivity objectives and history, new product development responsibility, responsibility for kitting parts, C-stock replenishment efficiency, supplier material scrap and rework, supplier cost-saving ideas implemented, supplier knowledge of lean.
- **Quality System Deployment:** Quality certification, quality process and measurement at each process and for each product, scrap and rework, problem solving process, product and customer quality data, quality ratings, new product startup process, continuous improvement environment, degree of focus on customer satisfaction , implementation of best practices, degree operational strategies are linked to corporate strategy, total quality system well-developed and deployed.

The RPA has an Assessment Questionnaire that asks an additional set of 20 questions whose answer is yes or no. More yeses equate to the more lean a company is. The RPA has been used to assess over 150 operations on 400 different plant tours including Donnelly Electronics, Eaton Corporation's Aeroquip Group, Haworth's office furniture plants, a Lockheed Martin division and Seagate Technology. The RPA can be used as a quick guide to assess competitors or suppliers business as well as an in-house evaluation. The average score is 55 out of a possible 121 for the assessment questions. The average number of yeses for the lean questionnaire is seven. The RPA is conducted in the following manner. Prior to the tour or visit, research is done on the company's financial status, website and other information using publicly available resources. Additionally one become familiar with the type of industry they will tour. A RPA team should be made up of a variety of experience levels and expertise. The team should not take notes on the tour but each team member should be responsible for a few categories to make some special mental notes. Directly after the tour the team meets and fills out individual questionnaires and then discusses high points and low points of the company.

The Rapid Industrial Plant Assessment (RIPA) developed for this project utilized the RPA as a guide to the types of questions and structure of the assessment. The RPA has been a proven industrial tool and the RIPA has used that experience and knowledge and tailored it to meet the needs of the AFRL. The RIPA has 27 targeted items that address nine categories that collapse into three measures of industrial preparedness. The nine categories are Market Analysis, Supply Chain, Customer Satisfaction, Profit,

Cash Flow, Capital, Leadership, Quality, and Lean Operations. The first three listed previously combine to rate a company's Value Chain. The next three rate a company's Financial performance and the last three rate a company's Operation Excellence. The 27 questions have three possible answers 0 (No), 1 (Somewhat), 2(Yes). The nine categories are rated on a 1 to 5 Likert Scale where 1 is Bad and 5 is World Class. The category ratings are mathematically related to the answers to the 27 questions and displayed in a three dimensional bubble graph. Another difference is that in order to accurately rate a plant, the RIPA team must reach a consensus rating of the plant in each of the nine categories above after each individual has completed a RIPA questionnaire.

### **Reference**

Goodsen, Eugene R.,(2002) "Read a Plant-Fast", Harvard Business Review, 105-113.

Goodsen, Eugene R., "Rapid Plant Assessment", <http://webuser.bus.umich.edu/Organizations/rpa>

### ***Baldrige National Quality Program***

The Malcom Baldrige National Quality Award was signed into law on August 20, 1987. The Award is named for Malcolm Baldrige, who served as Secretary of Commerce from 1981 until his death in a rodeo accident in 1987. Its intent is to make a national quality award program in the United States to help improve quality versus our foreign competitors. The findings and purposes of the law state that process and product quality have been challenged strongly by foreign competition, strategic planning for quality improvement programs are essential to the wellbeing of the Nation's economy. Improved management understanding of the factory floor and greater emphasis on statistical process control can lead to dramatic improvements in the cost and quality of products.

The concept of quality improvement is directly applicable to small companies as well as large and to service industries and the public sector. In order to be successful quality programs must be management-led and customer oriented. Several major industrial nations have successfully copied rigorous private-sector quality audits with national awards giving special recognition to those enterprises the audits identify as the very best. A National quality award of this kind the United States helps to improve quality and productivity. It stimulates American companies to improve quality by recognizing achievements of those companies that improve the quality of their goods and services, establishing guidelines and criteria that can be used by business, industry and government. It also provides specific guidance for other American organizations that wish to learn how to manage for high quality. The National Institute of Standards and Technology (NIST) heads this program to promote and recognize operational performance excellence. NIST is non-regulatory agency within the US Department of Commerce. Categories and questions from the Baldrige award were reviewed and utilized in initial drafts of the RIPA. This was done to anchor the RIPA instrument qualitatively to a known instrument as well as to provide input to an initial list of over 200 questions considered for the RIPA.

### **Reference**

"Baldrige National Quality Program". Baldrige National Quality Program. NIST. July 2 2007. <http://baldrige.nist.gov/> June 30 2007.

"National Institute of Standards and Technology". National Institute of Standards and Technology. June 29, 2007. <http://www.nist.gov/> July 2 2007.

## ***SYMLOG***

SYMLOG is an acronym for the Systematic Multiple Level Observation of Groups. It is a "system for the study of groups in the sense that it consists of a number of different parts, integrated to serve the purpose of making a particular group easier to understand and work with." (Bales, Cohen, Williamson, 1979) It is a set of methods for the study of groups of any kind, but basically small natural groups such as families, teams or classroom groups. The SYMLOG adjective rating instrument consists of 26 ratings which are traditionally scored on a scale of 0, 1, 2. The instrument display's its results (from either scoring system) graphically in a three dimensional bubble plot. This type of plot is used in the graphical display of the RIPA instrument where the size of the bubble corresponds to the Financial stability of the company of interest and the x and y axes correspond to Operational Excellence and Value Chain. The RIPA also borrows the 0, 1, 2 scale from this instrument. The 27 RIPA items are rated using 0, 1, 2 where 0 corresponds to No, 1 corresponds to Somewhat and 2 is Yes. The original SYMLOG instrument used a two-point scale of only yes or no, similar to the RPA. Research through the years led the purveyors of the SYMLOG instrument to change a the three point scale. This was the basis for the three-point scale for the RIPA.

## **Reference**

Bales, R. F., Cohen, Stephen P., Williamson, S. A. SYMLOG. 1979. The Free Press.

## ***University of Tennessee Development Staff***

Development of the RIPA and training was led by Allen Pannell with extensive participation by Dr. Mandyam Srinivasan, Dr. Dan Flint and Dr. Elaine Seat. Their years of practical and academic experience contributed to the initial set of questions and categories and ultimately to the selection of the final questions and categories. Sets of questions used in Mr. Pannell's consulting practice also were used.

## **APPENDIX D: MRL AND RIPA QUESTIONS COMPARISON**

The following is a brief summary of the MRL questions compared to the 27 RIPA questions. In a one sentence summary comparing the two methods of evaluation, the RIPA takes a broad stroke look at the company/contractor as a whole where as the MRL questions are small benchmarks specifically regarding the specific system or product. The following bullets give some examples for comparison.

- The MRL questions never assess the company's financials as a whole, only their ability to fund the current program (cost and funding thread). There are some questions about cost improvement but all regarding cost reduction within this certain program.
- The RIPA is a snapshot in time where as the MRL questions change as the level changes. For instance in MRL 4 in the Process Capability and Control thread the question is asked if "yield and rates assessment on proposed processes complete" and in MRL 8 the question asks if "yield and rates required to begin LRIP verified using SDD articles."
- The MRLs focus on training programs and whether or not personnel are properly trained whereas the RIPA asks about the personnel's ability to affect the quality of a product. The RIPA addresses whether or not personnel in the plant are focused on quality and if those personnel are empowered to do anything about poor quality. In the Personnel thread, the questions are concentrated on training benchmarks to reach the appropriate MRA level.
- The RIPA addresses market for the system or product. The MRL questions do not address the possible market or marketing ability of the contractor/company.
- The MRLs have some questions dealing with the company's suppliers and how they are managed and does not address customer relationships. The RIPA briefly mentions suppliers in question 14 but questions the contractor/company's customer relationships in three separate questions.
- The MRL discusses process flow, but only in the context of that particular line and those questions change with each MRL. The RIPA asks if the workplace in general is conducive to good process flow.
- The MRL never directly addresses the value chain.

## **APPENDIX E: COMPANY A VISIT SUMMARY**

### **Introduction**

Company A is a privately owned, small business that provides specialty materials as a supplier of aerospace/space/and military application parts. They provide high strength, custom-designed lightweight components. They have a history of designing and producing low volume components that can be hand constructed. However, they are presently pursuing certification of aerospace parts that can become a standard product for the aerospace MRO industry.

Company A is the result of a large company spin-off of this technology. Many of the professional staff have relocated to Company A to continue working with the technology. Although Company A is new to this business, the staff has a long history and expertise in the R&D application of the technology. Five years ago, Company A was a manufacturer of crude products for military field application. They continue this line of business. Their specialty materials business is new and derived from the technology spin-off. There is no connection between the original company mission and today's mission.

They are presently ramping up from a research house to a product supplier of their proprietary technology. Company A is moving from a pure research facility to research and production. They are presently growing their manufacturing capability. They plan to increase their gross by 500% in five years.

Company A is ISO 9001 and AS9004 certified.

### **Interview and Tour Summary**

Company A's management team has developed an extensive business plan. The purpose of this plan is to secure necessary funding capital for improvements required for production. Company A's strength is technical problem solving. They have little expertise with production.

#### **Management Debrief**

The management team was interviewed regarding 1) how they have changed in the last five years and 2) what they believe to be their biggest challenges and obstacles.

### **Methodology**

The Company A management team evaluated their company in four different ways. Each data set was provided independently by each member of the Company team in paper and pencil mode. The four data sets are:

Data Index 6: Scoring of the 27 items for present state.

Data Index 7: Scoring of the company on the nine categories in its present state (1-5 scale).

Data Index 8: Scoring of the company on the 27 items five years ago.

Data Index 9: Scoring of the company on the nine categories five years ago (1-5 scale).

The management team did not discuss their ratings or reach consensus.

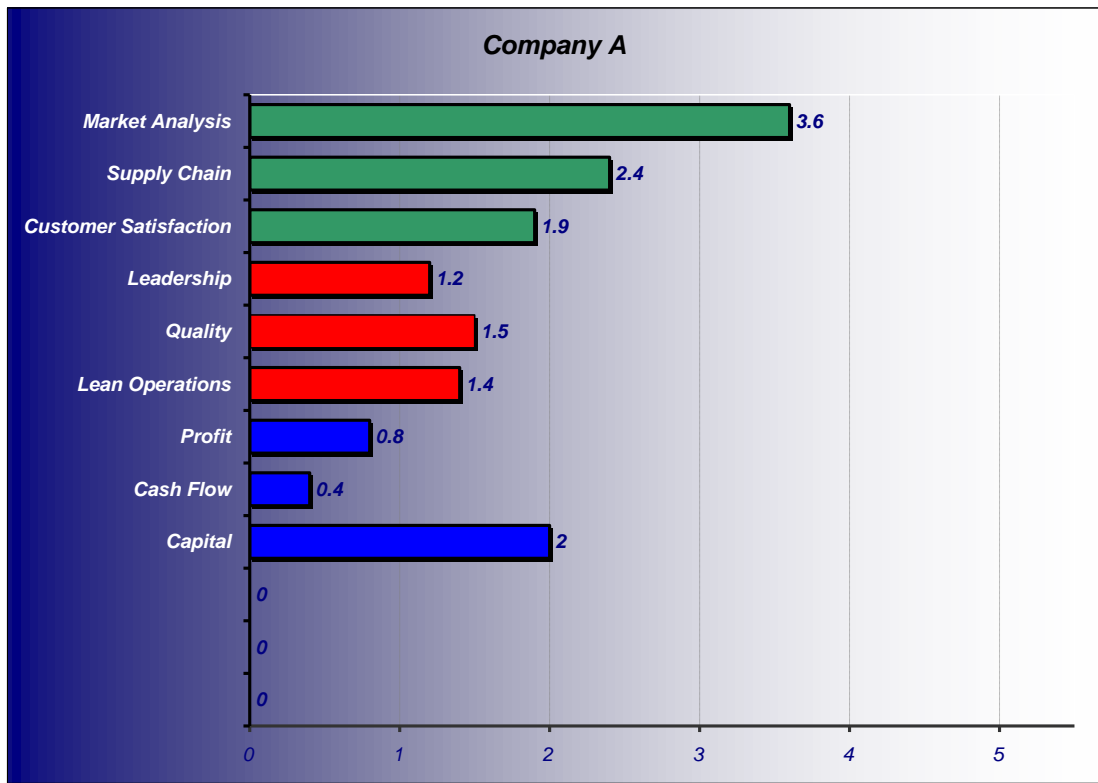
The data were input into the RIPA assessment spreadsheet by the UT team of researchers.

The UT team arrived at their RIPA results by each team member independently answering the 27 items (data index 3) and then reaching consensus as a team on the final score for each of the nine categories (data index 5).

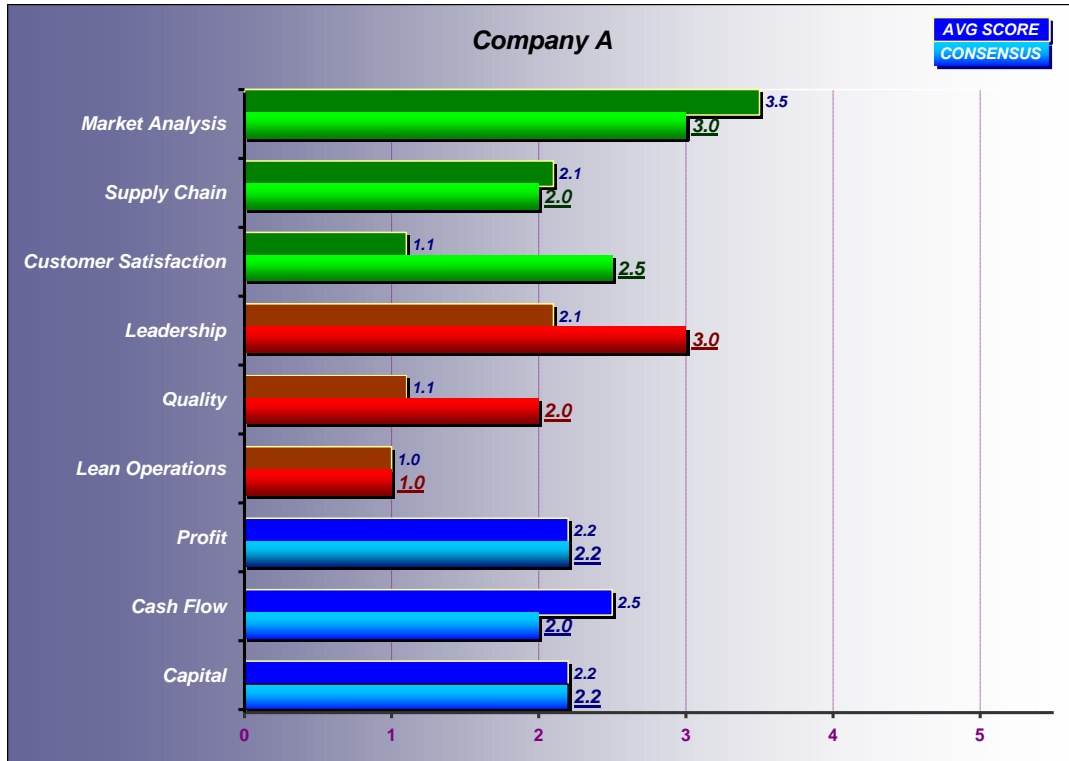
## Data

### RIPA Data

Figure 13 provides the nine item scores as generated by the RIPA calculator for the Company A management team's input of the 27 items. Figure 14 provides the UT team's scores for the nine items generated by the RIPA calculator and their consensus scores.



**Figure 13. Company A – Management's Rating From Input of 27 Items (Data Index 10)**



**Figure 14. Company A – UT Team’s Evaluation From Consensus (Data Index 5)**

Figure 15 provides a graphical comparison using the RIPA bubble chart representation of the management team’s evaluation of now and five years ago, and the evaluation from the UT team. Company A managers evaluated their company using the 27 items both now and five years prior.

Company A was in a unique position when evaluating themselves five years prior because they may have the same name, but are not the same company and they now have a different mission. However, their ability to change the culture to a new mission and type of work will be important to their success.

The data used in the Company A management charts comes directly from their scores on the 27 items.

### **Qualitative Data**

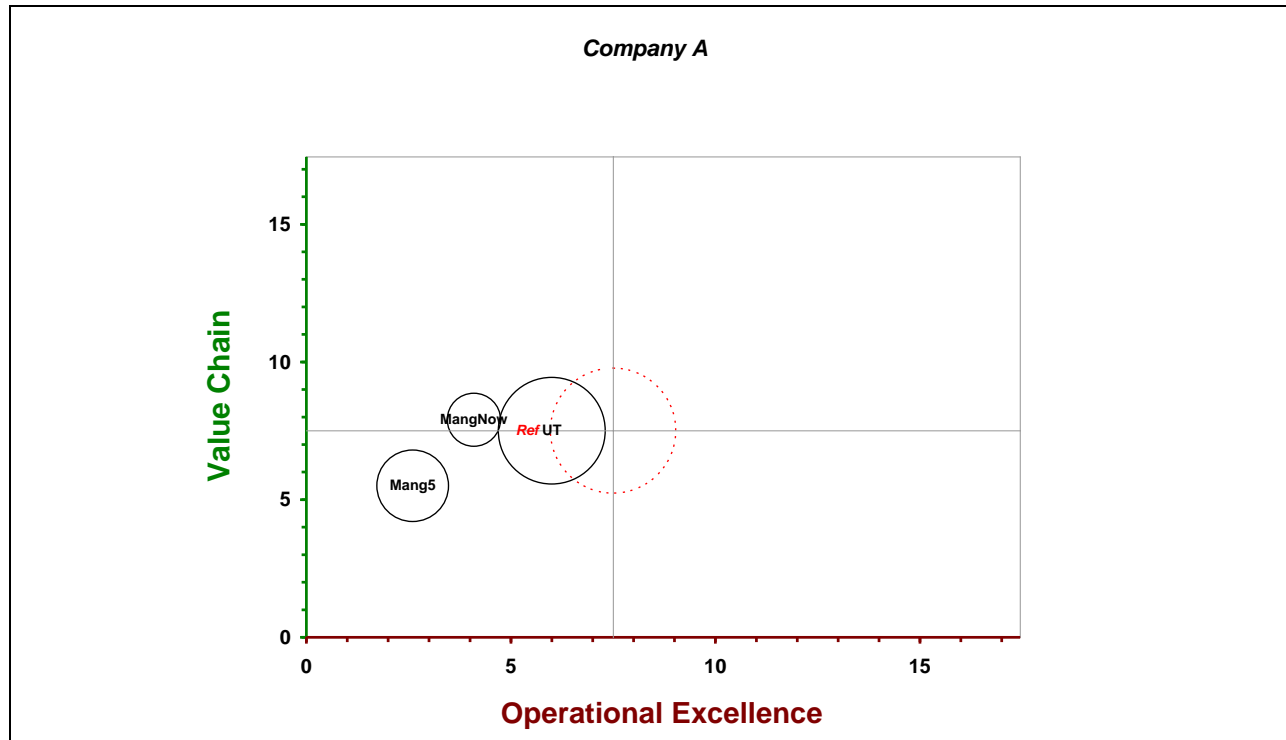
The management team responded to two questions to provide qualitative data. The intent of this questioning was to gather supporting information for 1) the five year previous RIPA input and 2) the present RIPA from a casual dialogue with the Company A management team.

*What has changed over the last five years?*

- Their facility had a completely different mission and product that only required crude techniques for manufacturing and their new mission requires precision techniques.

*What challenges/obstacles face your company?*

- Stay creative while also doing production.
- Create product in a reliable way.



**Figure 15. Company A – All RIPA Evaluations  
(Company A Now, Company A Five Years Ago and UT Team)**

### Analysis

Company A is moving from a research facility to a manufacturing facility with specific components they manufacture. They have a history of producing one of a kind single components to specification. They have been actively developing a marketing plan in an attempt to become a manufacturing facility.

### Summary of Results

Figure 15 facilitates a comparison of all scores from the RIPA survey of Company A. This graphic suggests:

- The UT team estimated the financial viability of Company A higher than the management team. Company A is privately owned, and the difficulty in making capital expenditures necessary for the business expansion was perceived to be greater by those in the company than the UT team. Although the UT team financial circle is larger than the management team's circle, both are smaller than the reference circle (midpoint).
- The UT team had scores that were most dissimilar to the Company A management team's scores on the factors that make up Operational Excellence. Company A is undergoing a change and as such, they had inconsistent scores that reflect their range of performance on Leadership, Lean, and Quality. Depending on the specific task, they had a range of performance.
- The management team and the UT team both scored Company A the same for the Value Stream construct. Company A has produced specialty products that, although perhaps late on delivery and expensive, met the customer's performance expectations. Company A has received positive feedback from customers and has a marketing plan for future improved financial performance. Thus, they have scores at or slightly above the reference line in the Value Stream component.



## **APPENDIX F: COMPANY C VISIT SUMMARY**

### **Introduction**

Company C makes industrial adhesives for the non-wovens market. They use a limited number of raw ingredients to produce many different adhesive products. These products are provided to the customer in several different forms. Company C produces commodity adhesive products and their key process index is cost per pound where most of that cost is associated with labor. Company C is a stand-alone manufacturing facility with no marketing, sales, financial or human resources on site. Those functions are performed on a corporate wide basis from a central organization. Company C is a cost center for their parent company.

Company C is required to make a 6% improvement in productivity each year where the metric is pounds per labor hour.

### **Interview and Tour Summary**

Company C has a continuous flow into it's facility of raw materials to make adhesives and a continuous flow out of finished adhesive product. The atmosphere is hot and unpleasant to many potential employees. The work is not difficult and pays low wages. However, employees with out educational credentials have the opportunity for steady work.

We were debriefed by the plant manager. This facility is undergoing improvements to its process. The employees are learning data-driven process control. The percent of quality problems has been reduced from 10 percent to two percent within the last five years due to process monitoring and improvements.

Company C is focused on their customers and understands their place in the supply chain. They believe that this customer focus may be carried to a fault as it affects batch size, product form, and delivery in a manner that is not cost effective. Understanding customer requirements and product mix is a focus area for improvement.

### **Management Debrief**

The plant manager was interviewed regarding 1) how they have changed in the last five years and 2) what they believe to be their biggest challenges and obstacles.

### **Methodology**

The Company C management team evaluated their company in four different ways. Each data set was provided independently by each member of the Company team in paper and pencil mode. The four data sets are:

- Data Index 6: Scoring of the 27 items for present state.
- Data Index 7: Scoring of the company on the nine categories in its present state (one through five scale).
- Data Index 8: Scoring of the company on the 27 items five years ago.
- Data Index 9: Scoring of the company on the nine categories five years ago (one through five scale).

The management team did not discuss their ratings or reach consensus.

The data was input into the RIPA spreadsheet by the UT team of researchers.

The UT team arrived at their RIPA results by each team member independently answering the 27 items (data index 3) and then reaching consensus as a team on the final score for each of the nine categories (data index 5).

Allen Pannell knew this company from prior consulting work. For this visit, Maria Weese and Elaine Seat served as the evaluators. The UT team RIPA score was generated from their input and consensus scores. Allen Pannell served as the expert evaluator and his input is provided in Figure 18 for comparison with the management team and UT team scores.

## Data

### RIPA Data

Figure 16 provides the nine item scores as generated by the RIPA calculator for the Company C management team's input of the 27 items. Figure 17 provides the UT team's for the nine items as generated by the RIPA calculator of the 27 items and the consensus scores.

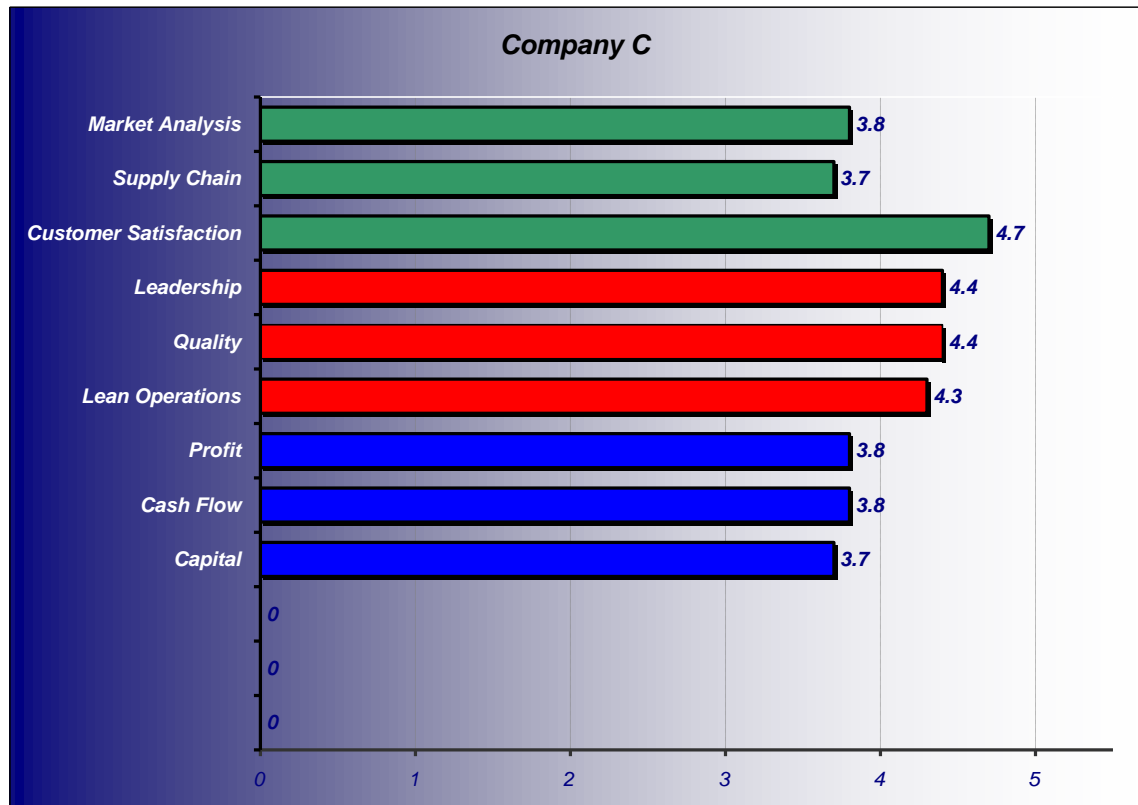
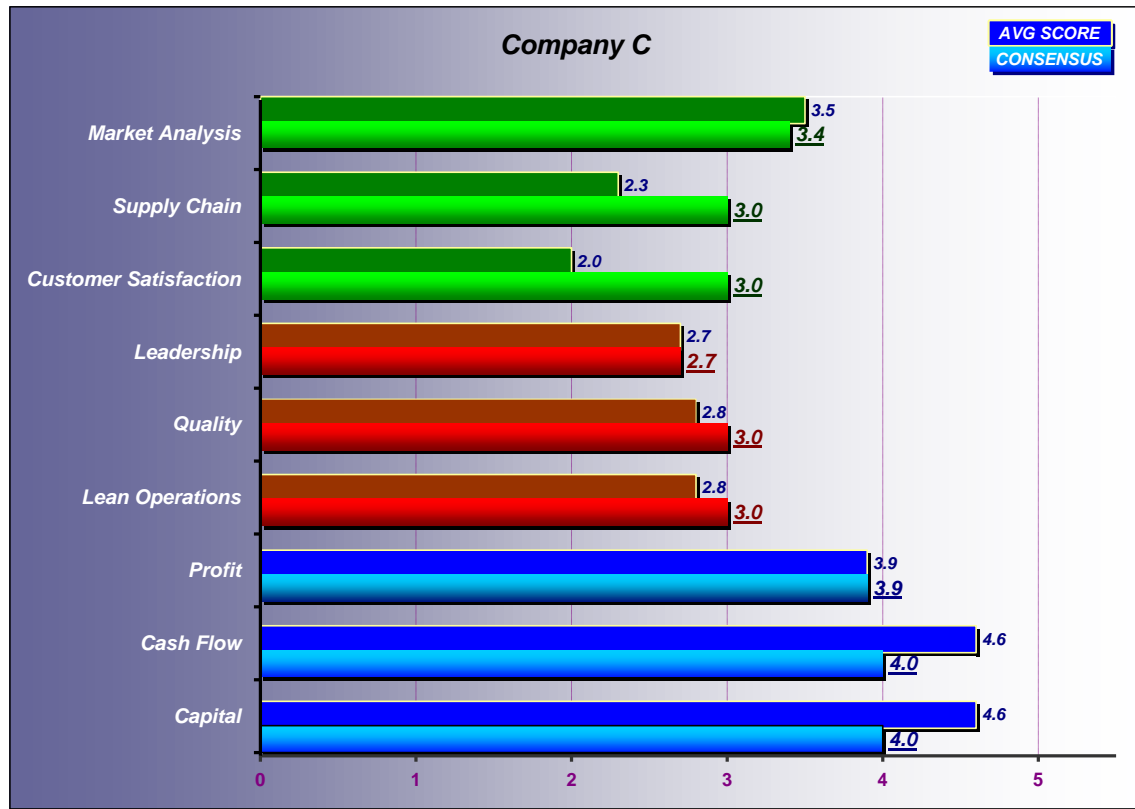


Figure 16. Company C – Management's Rating From Input of 27 Items (Data Index 10)



**Figure 17. Company C – UT Team’s Evaluation From Consensus (Data Index 5)**

Figure 18 provides a graphical comparison of the management team’s evaluation of now and 5 years ago, and the evaluation from the UT team.

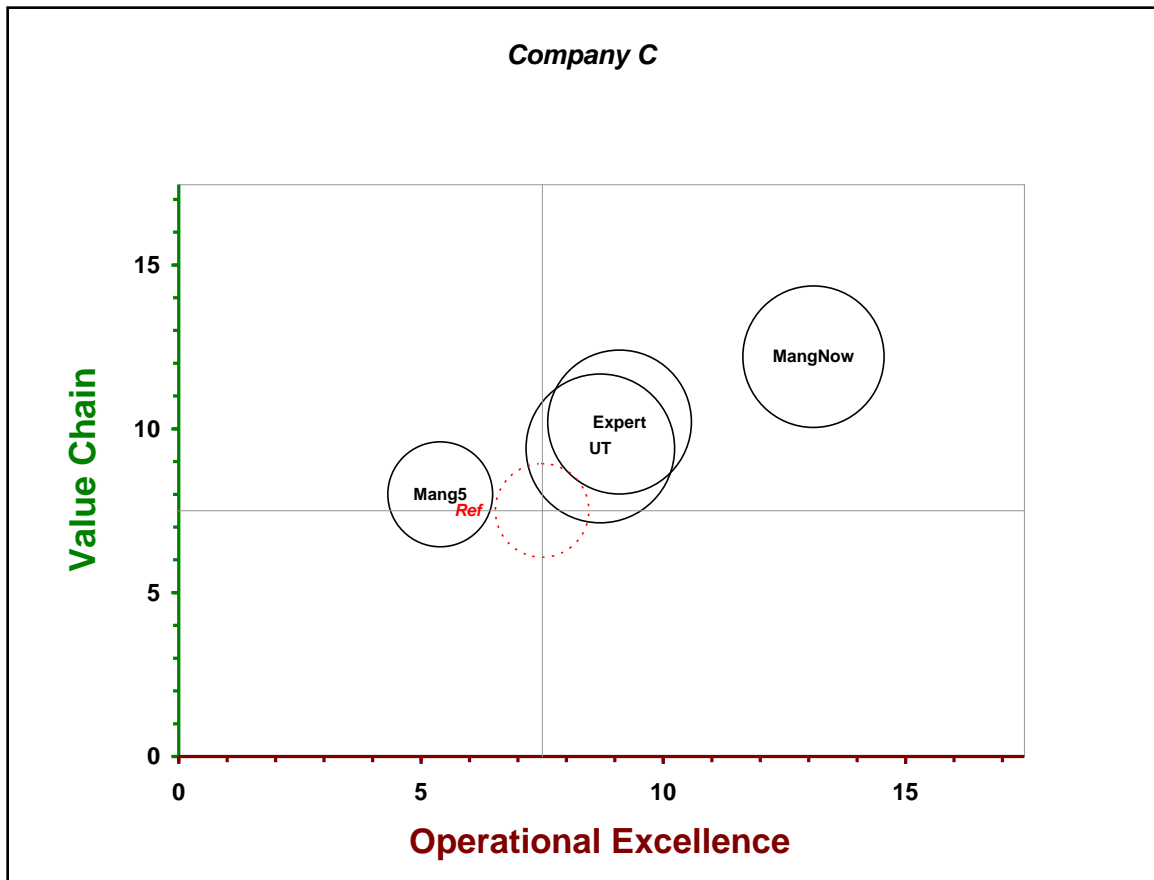
The data used in the Company C management charts comes directly from their scores on the 27 items.

### **Qualitative Data**

The management team responded to two questions to provide qualitative data. The intent of this questioning was to gather supporting information for 1) the five year previous RIPA input and 2) the present RIPA from a casual dialogue with the Company C management team.

*What has changed over the last five years?*

- Now there is a vision and tools to execute change.
- Making data driven decisions (measures, determine where you are and where you want to go).



**Figure 18. Company C – All RIPA Evaluations (Company C and UT Team)**

*What challenges/obstacles face your company?*

- Understanding change doesn't happen overnight.
- Having team leaders who can understand and execute continual change.
- Having validated procedures.

### **Summary of Results**

The RIPA data suggests the following conclusions:

- The bubble in Figure 18 by the management team is significantly higher in Operational Excellence and the Value Stream than the UT team and the expert rating. This quantitative data suggests that the company faced a challenge of having all players understand change and exactly where the company was. This was demonstrated to the UT team in individual interviews when the lower level managers did not have the same opinion and attitudes toward the company as the top management. This inflated management score is representative of the disconnect between reality of the company and what was observed.
- The UT team and the expert reached the same RIPA scores. This indicates that the RIPA is providing the same feedback from trained observers and experts with inside knowledge of a company. (See Company D for this same circumstance and result).

- Company C has been on a course of Lean training and business improvement for last several years. This is manifest in the improved scores from five years ago and the present.
- Management receives funding for capital projects from their central office in competition with other cost centers. As Lean techniques and data driven decision making have been implemented, the Company's ability to receive funding for capital improvements has improved, along with production efficiencies.

## **APPENDIX G: COMPANY D VISIT SUMMARY**

### **Introduction**

Company D makes industrial adhesives for the non-wovens market. They use a limited number of raw ingredients to produce over 100 different adhesive products. They produce no retail products. Company D produces commodity adhesive products and their key process index is cost per pound where most of that cost is associated with labor. Company D is a stand-alone manufacturing facility with no marketing, sales, financial or human resources on site. Those functions are performed on a corporate wide basis from a central organization. Company D is a cost center for their parent company.

Company D is required to make a six percent improvement in productivity each year where the metric is pounds per labor hour.

### **Interview and Tour Summary**

Company D's employees were very receptive and interviews were relaxed and informative. Their shop appeared orderly, organized, well lit and well marked. There were metrics posted not only in the meeting room but on the shop floor and in the break room. Additionally, there was a kiosk that rotated through production information, quality information, key process indicators and other information in the main lobby and in the break room. Company D did a very good job of communicating within their facility to their employees. Their facility is laid out to promote efficiency, with all of the receiving in one spot and the shipping in for all the different product lines in another.

Company D is dedicated to quality and leanness, although they admit sometimes they feel *too lean*. They employ a seven step procedure for problem solving throughout the entire organization. Company D has a unique management system in that there are no shift supervisors only team leaders. These team leaders work on the day shift and do not directly supervise the first shift. Each team lead has other responsibilities beyond just their team at an organizational level. The shifts are responsible entirely for themselves.

### **Management Debrief**

The management team was interviewed regarding 1) how they have changed in the last five years and 2) what they believe to be their biggest challenges and obstacles.

### **Methodology**

The Company D management team evaluated their company in four different ways. Each data set was provided independently by each member of the Company team in paper and pencil mode. The four data sets are:

- Data Index 6: Scoring of the 27 items for present state.
- Data Index 7: Scoring of the company on the nine categories in its present state (one through five scale).
- Data Index 8: Scoring of the company on the 27 items five years ago.
- Data Index 9: Scoring of the company on the nine categories five years ago (1 through 5 scale).

The management team did not discuss their ratings or reach consensus.

The data was input into the RIPA assessment spreadsheet by the UT team of researchers.

The UT team arrived at their RIPA results by each team member independently answering the 27 items (data index 3) and then reaching consensus as a team on the final score for each of the nine categories (data index 5).

Allen Pannell knew this company from prior consulting work. For this visit, Maria Weese and Elaine Seat served as the evaluators. The UT team RIPA score was generated from their input and consensus scores. Allen Pannell served as the expert evaluator and his input is provided in Figure 21 and Figure 18 for comparison with the management team and UT team scores.

## Data

### RIPA Data

Figure 19 provides the nine item scores as generated by the RIPA calculator for the Company D management team's input of the 27 items. Figure 20 provides UT evaluation team's scores for the nine items as generated by the RIPA calculator of the 27 items and the consensus scores.

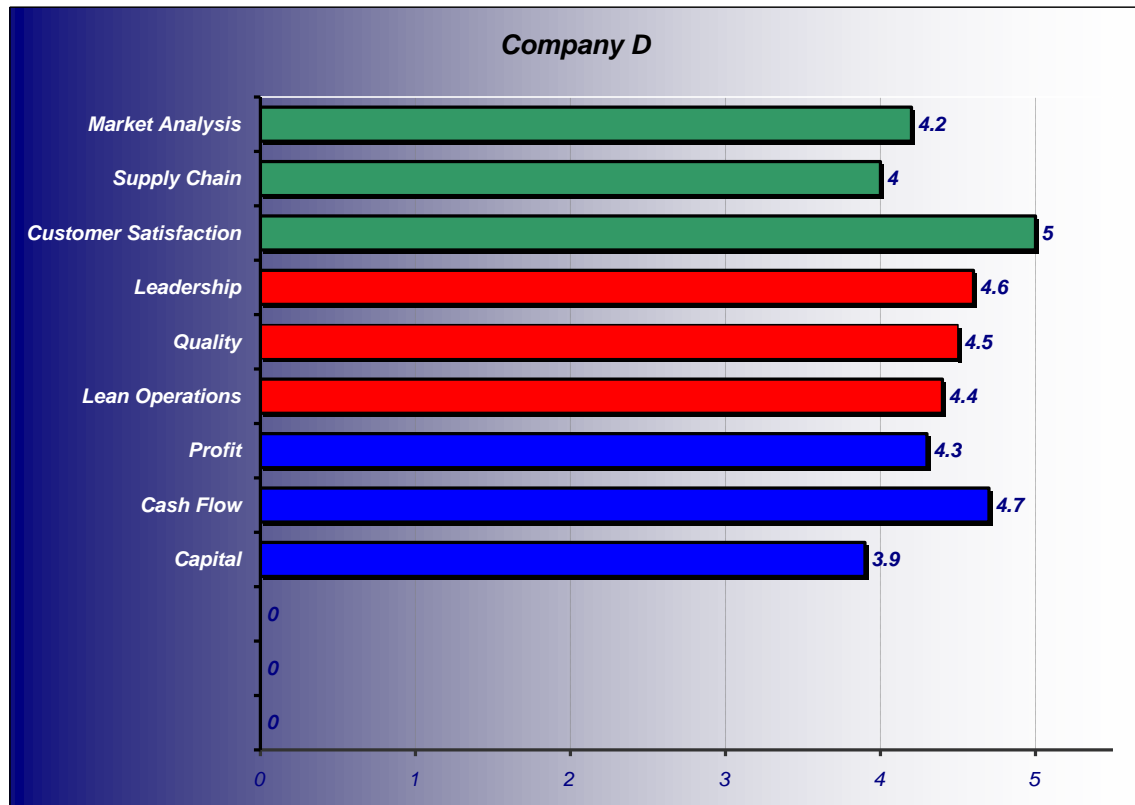
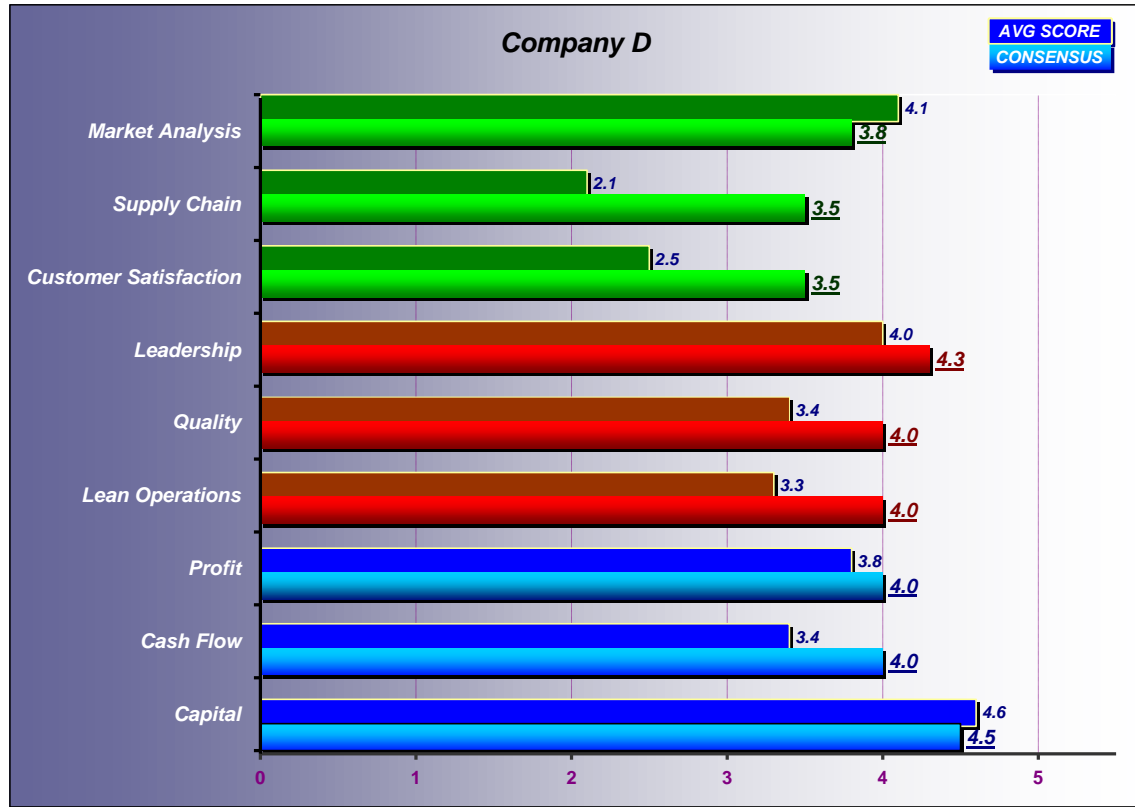


Figure 19. Company D – Management's Nine Item Rating From Input of 27 Items (Data Index 10)



**Figure 20. Company D – Evaluation – UT Team’s Evaluation From Consensus (Data Index 5)**

Figure 18 provides a graphical comparison of the management team’s evaluation of now and five years ago, and the evaluation from the UT team.

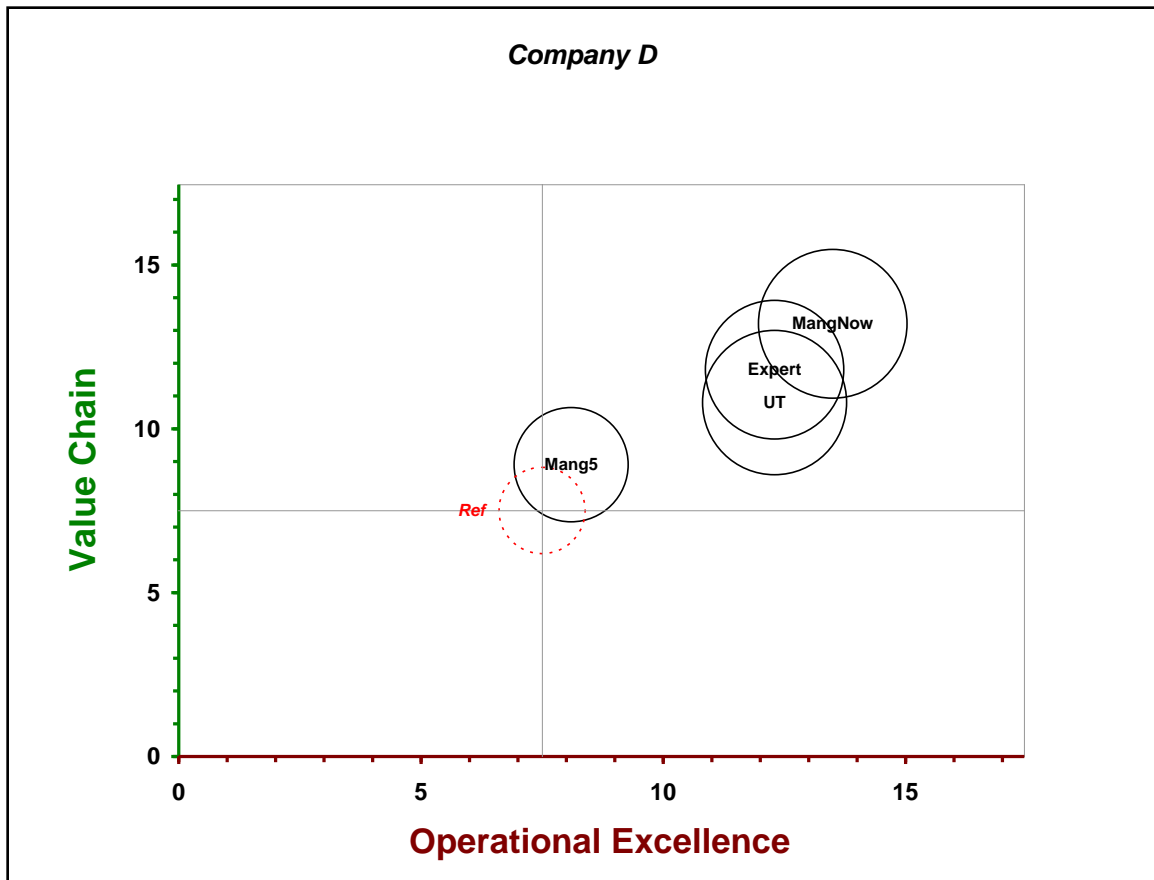
### Qualitative Data

The management team responded to two questions to provide qualitative data. The intent of this questioning was to gather supporting information for 1) the five year previous RIPA input and 2) the present RIPA from a casual dialogue with the Company D management team.

*What has changed over the last five years?*

- Development of the staff.
- Lots of benchmarking to develop optimum processes.





**Figure 21. Company D – All RIPA Evaluations  
(Company D Now, Company D Five Years Ago and UT Team)**

*What challenges/obstacles face your company?*

- Getting everyone on the same page.
- Adequate staffing.
- Getting our suppliers evaluated and part of our process.
- Being proactive and not reactive.

### **Analysis**

Company D received a high rating in every category with their highest of 4.5 being in capital. Since Company D can obtain capital from their corporate office and they operate with such efficiency their operational excellence is high.

Company D has taken a structured approach to improving their operational processes for several years. They understand that their product is a commodity and they also understand their place in the supply chain for their downstream customers. As such, they have focused on eliminating any waste. This focus is evident from observation, impromptu talks with shop personnel, and posted data.

The financial data presented by Company D management supports their improvement in processes and eliminating waste as their price per pound of product has declined over the last five years.

## Summary of Results

Figure 21 facilitates a comparison of all scores from the RIPA survey of Company D. This graphic suggests:

- Company D shows in its RIPA evaluations big improvements over the past five years.
- The UT team and the expert reached the same RIPA scores. This indicates that the RIPA is providing the same feedback from trained observers and experts with inside knowledge of a company. (See Company C for this same circumstance and result).
- Company D has been on a course of Lean training and business improvement for last several years. This is manifest in the improved scores from five years ago and the present.
- Management receives funding for capital projects from their central office in competition with other cost centers. As Lean techniques and data driven decision making have been implemented, the Company's ability to receive funding for capital improvements has improved, along with production efficiencies.

## **APPENDIX H: COMPANY E VISIT SUMMARY**

### **Introduction**

Company E is a Tier III, low volume high mix military/aerospace and medical/industrial contract manufacturing facility. They primarily operate in electronics and communications. Much of their work is in the defense industry. Company E has over 150 different end products per month and has over 100,000 different products in their product catalogue. Company E's sales have grown by almost 40 percent in the past two years.

Company E is part of a larger public corporation that is active in acquiring other companies.

Company E has a focus on operational excellence and waste reduction. They use price of nonconformance as a key process indicator measured as a percent of their business each year. They have a goal of a 20 percent year over year waste reduction. Company E has their own lean program headed by a council that meets quarterly to share best practices within the company. On their site alone, there are eight Six Sigma certified Black or Green belts. 90 percent of the facility has been through eight hours of lean training and the use of Six Sigma tools. Company E is ISO and DoD certified.

Company E focuses on customer service by not letting a customer get lost in the mix and by manufacturing things that no one else wants to make. They look to maintain a few large and secure customers. Their marketing is based on horizontal expansion, they look to do so well on a first project that the customer always comes back.

### **Interview and Tour Summary**

Company E's shop is organized like factories within a factory. Work cells have cut transfer time on the shop floor and allow for visual management. Operators always work in the same cells and are trained to do the jobs in those cells. Overall the shop was neat, there were metrics posted and operators very nice to greet us as we toured. There were some secure areas where product can be manufactured separately to meet proprietary and/or security requirements.

Employees were interviewed. The company is like a family and is one of the few high tech stable employers in the area. The employees are satisfied and enjoy the family atmosphere.

### **Management Debrief**

The plant manager was interviewed regarding 1) how they have changed in the last five years, 2) what they believe to be their biggest challenges and obstacles, and 3) what they believe their strengths to be.

### **Methodology**

The Company E management team evaluated their company in four different ways. Each data set was provided independently by each member of the Company team in paper and pencil mode. The four data sets are:

- Data Index 6: Scoring of the 27 items for present state.
- Data Index 7: Scoring of the company on the nine categories in its present state (1 through 5 scale).
- Data Index 8: Scoring of the company on the 27 items five years ago.
- Data Index 9: Scoring of the company on the nine categories five years ago (1 through 5 scale).

The management team did not discuss their ratings or reach consensus.

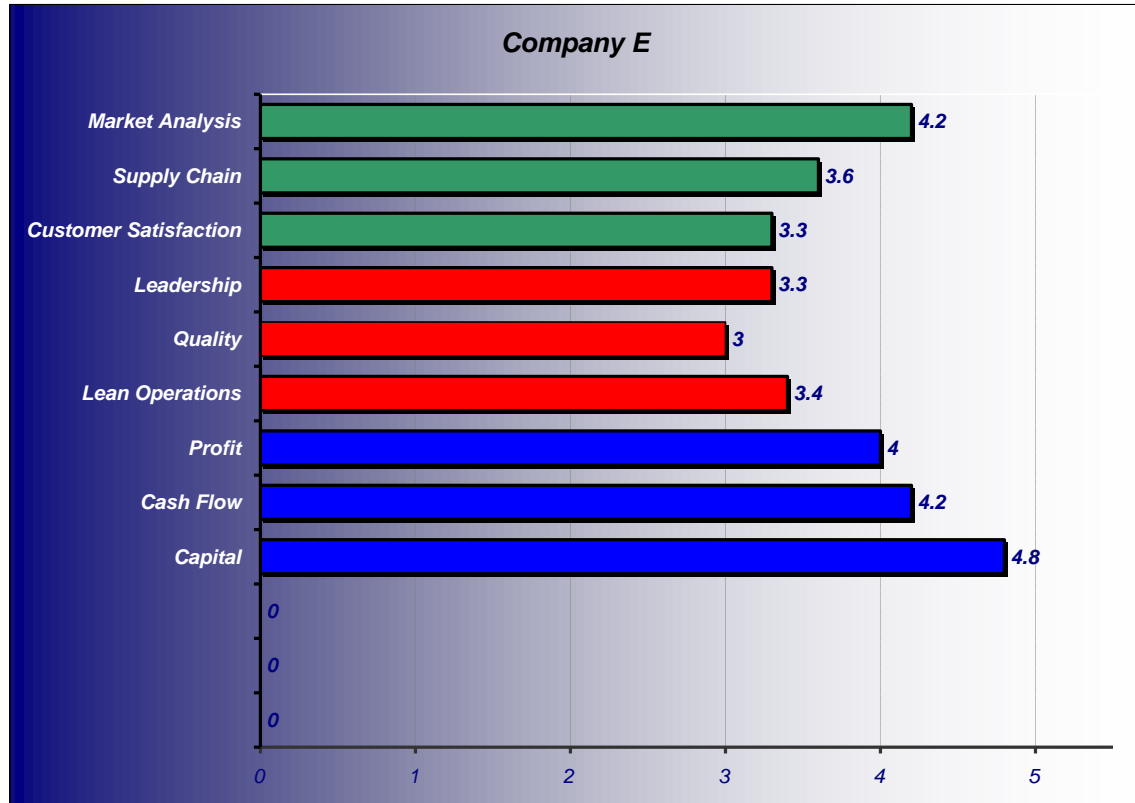
The data was input into the RIPA assessment spreadsheet by the UT team of researchers.

The UT team arrived at their RIPA results by each team member independently answering the 27 items (data index 3) and then reaching consensus as a team on the final score for each of the nine categories (data index 5).

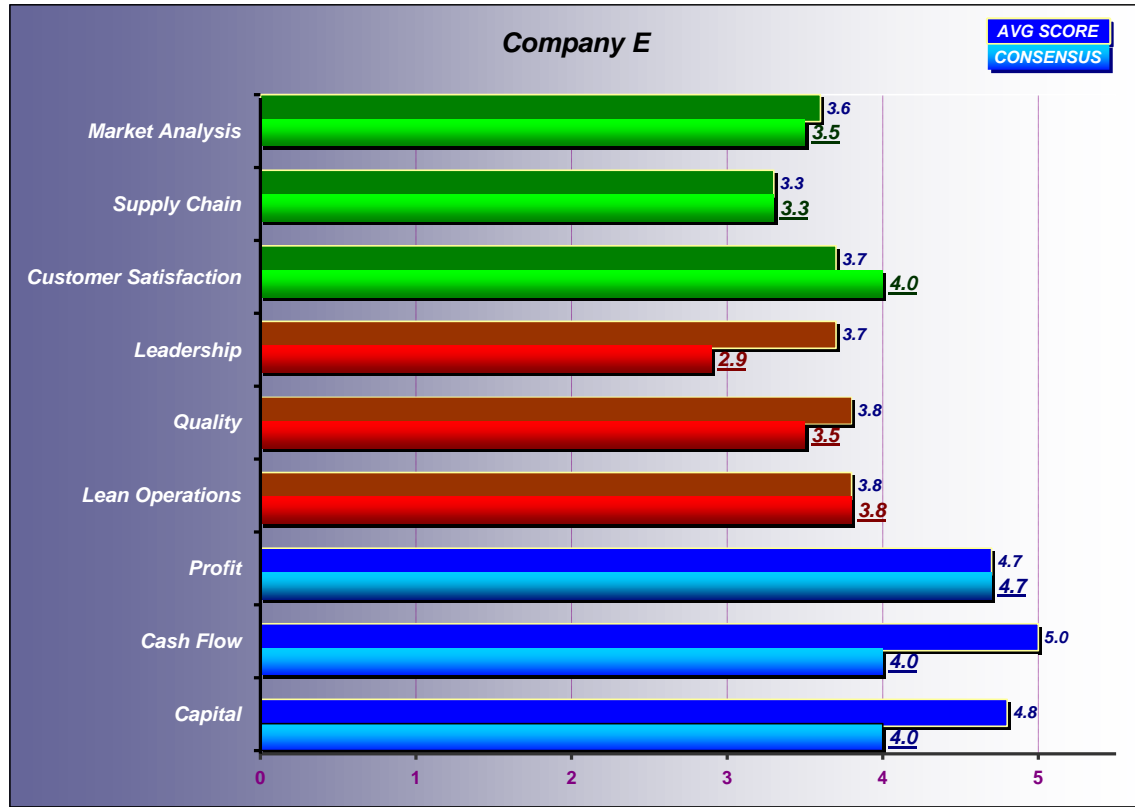
## Data

### RIPA Data

Figure 22 provides the nine item scores as generated by the RIPA calculator for the Company E management team's input of the 27 items. Figure 23 provides the UT team's scores for the nine items as generated by the RIPA calculator of the 27 items and the consensus scores.



**Figure 22. Company E – Management's Rating From Input of 27 Items (Data Index 10)**



**Figure 23. Company E – UT Team’s Evaluation From Consensus (Data Index 5)**

Figure 24 provides a graphical comparison of the management team’s evaluation of now and five years ago, and the evaluation from the UT team.

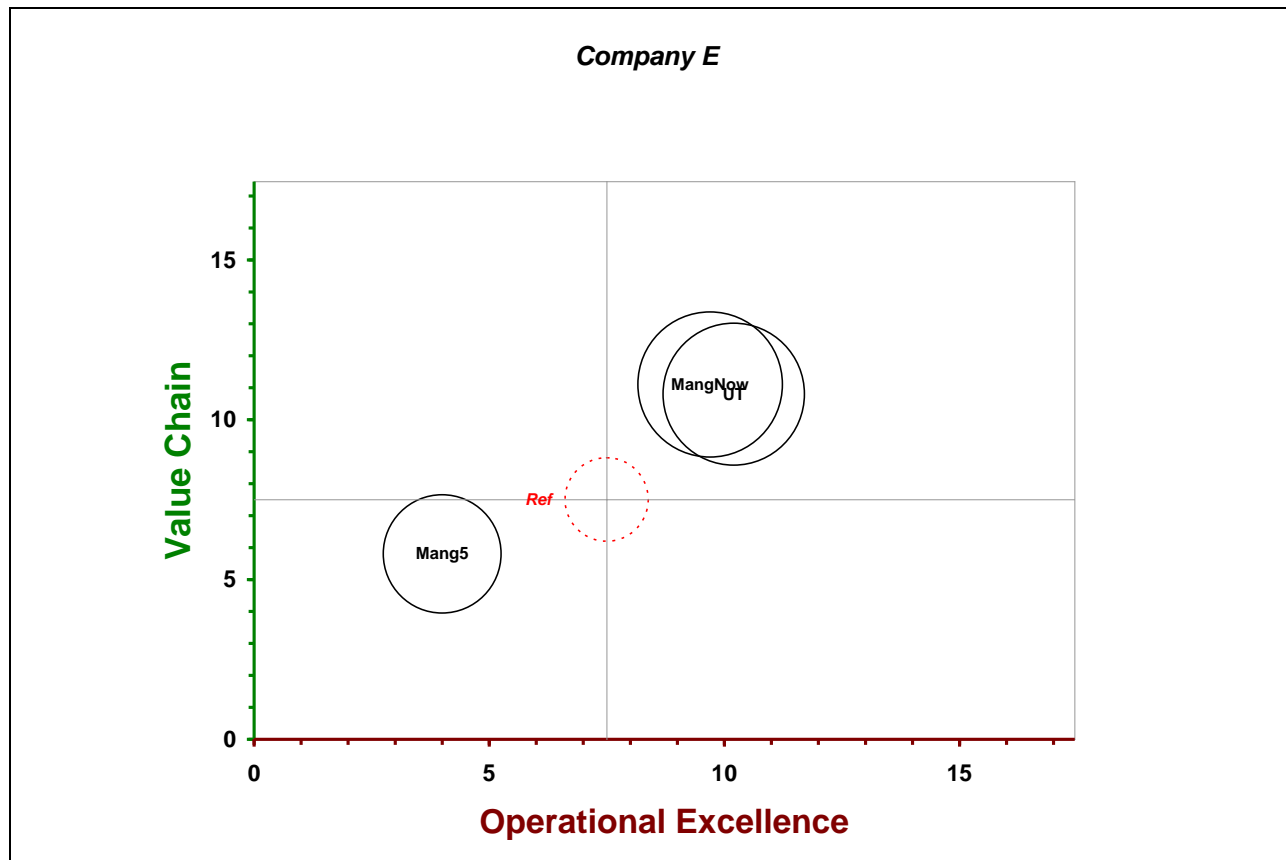
Company E was asked to fill out a nine question survey evaluating itself in the nine categories now and five years prior. Additionally they were asked to evaluate themselves using the 27 RIPA questions for now and five years prior.

### **Qualitative Data**

The management team responded to two questions to provide qualitative data. The intent of this questioning was to gather supporting information for 1) the five year previous RIPA input and 2) the present RIPA from a casual dialogue with the Company E management team.

*What has changed over the last five years?*

- New management structure.
- Total turnover in management staff.
- Automation at all levels.



**Figure 24. Company E – All RIPA Evaluations  
(Company E Now, Company E Five Years Ago and UT Team)**

*What challenges/obstacles face your company?*

- Their supply chain of suppliers.
- Empowering the workforce so management can be efficient.
- Making financial management more of a priority.

*What are your strengths?*

- Customer Satisfaction.
- Don't use anecdotal evidence to make decisions.

## Summary of Results

Figure 24 facilitates a comparison of all scores from the RIPA survey of Company E. This graphic suggests:

- The RIPA scores from the UT team and the management team are in alignment.
- Company E has access to capital as evidenced by recent significant capital improvements in their facility. These recent improvements are evidenced in the improved management scores from five years ago and the present, and the UT team's ability to observe these improvements.
- Company E management reported that they needed to better attend to financials, but in their RIPA reporting, they provided high scores in financials.
- Company E is an established company that provided detailed information, access to employees for personal interviews, and a detailed tour of the facilities. This meeting took three hours, and facilitated the team evaluating Company E the same as management's evaluation.
- Company E's comments regarding the changes in their workplace from five years ago are reflected in their five years ago and present RIPA evaluations.

## **APPENDIX I: COMPANY F VISIT SUMMARY**

### **Introduction**

Company F is an employee owned conglomerate consisting of four business units. All of the business units manufacture vibration measurement and balancing equipment designed for field use by technicians in nuclear applications, electrical applications, aeronautics and materials testing. They expect 10 percent profit and 10 percent growth annually.

The company has sales worldwide and has a strong marketing team and product presence. They have focus on customer satisfaction with their product and accurate performance of their instrumentation. They have carefully analyzed the marketplace and focused their effort in niches where they can be the best.

### **Interview and Tour Summary**

The president of the company and marketing manager met with our team. The president presented an overview of the company. It included not only where Company F is today, but where they wish to be in the future. They view themselves as problem solvers for their customers and frequently that is how they gain market share in a business. We toured their facility with visits to engineering, the testing laboratory, and the manufacturing floor.

### **Management Debrief**

The management team was interviewed regarding 1) how they have changed in the last five years and 2) what they would change to see improved performance.

### **Methodology**

The Company F management team evaluated their company in three different ways. Each data set was provided independently by each member of the Company team in paper and pencil mode. The three data sets are:

- Data Index 6: Scoring of the 27 items for present state.
- Data Index 7: Scoring of the company on the nine categories in its present state (one through five scale).
- Data Index 9: Scoring of the company on the nine categories five years ago (one through five scale).

The management team did not discuss their ratings or reach consensus.

The data was input into the RIPA spreadsheet by the UT team of researchers.

The UT team arrived at their RIPA results by each team member independently answering the 27 items (data index 3) and then reaching consensus as a team on the final score for each of the nine categories (data index 5).

### **Data**

#### **RIPA Data**

Figure 25 provides the nine item scores as generated by the RIPA calculator for the Company A management team's input of the 27 items. Figure 26 provides the UT team's scores for the nine items as generated by the RIPA calculator of the 27 items and the consensus scores.



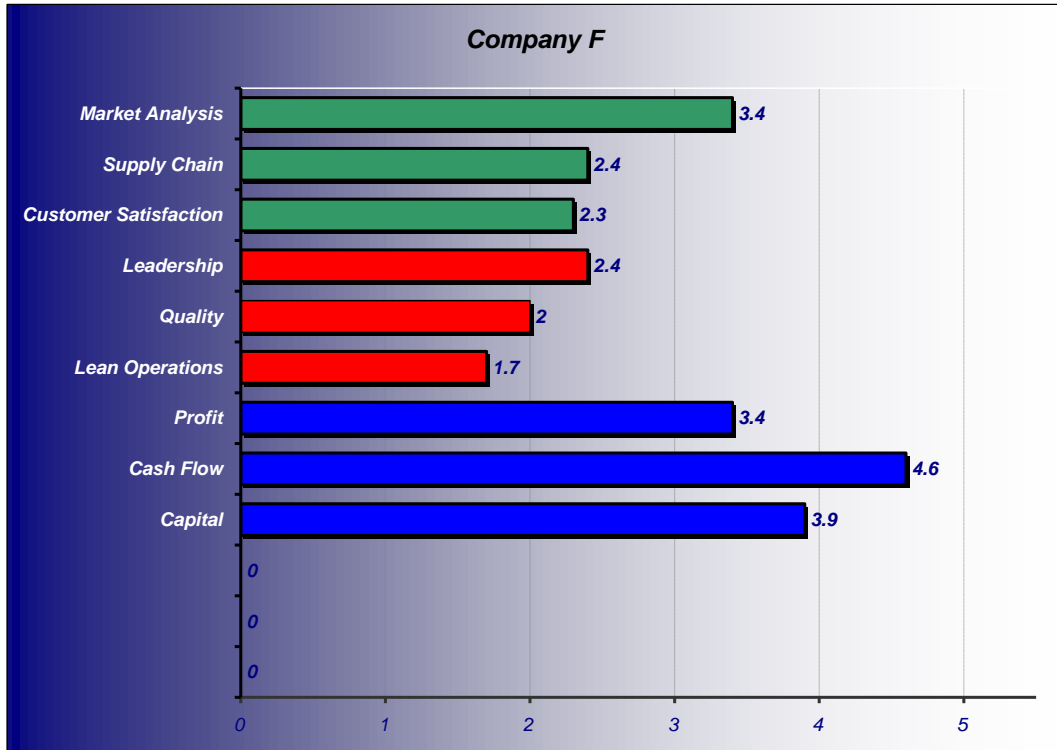


Figure 25. Company F – Management’s Rating From Input of 27 Items (Data Index 10)

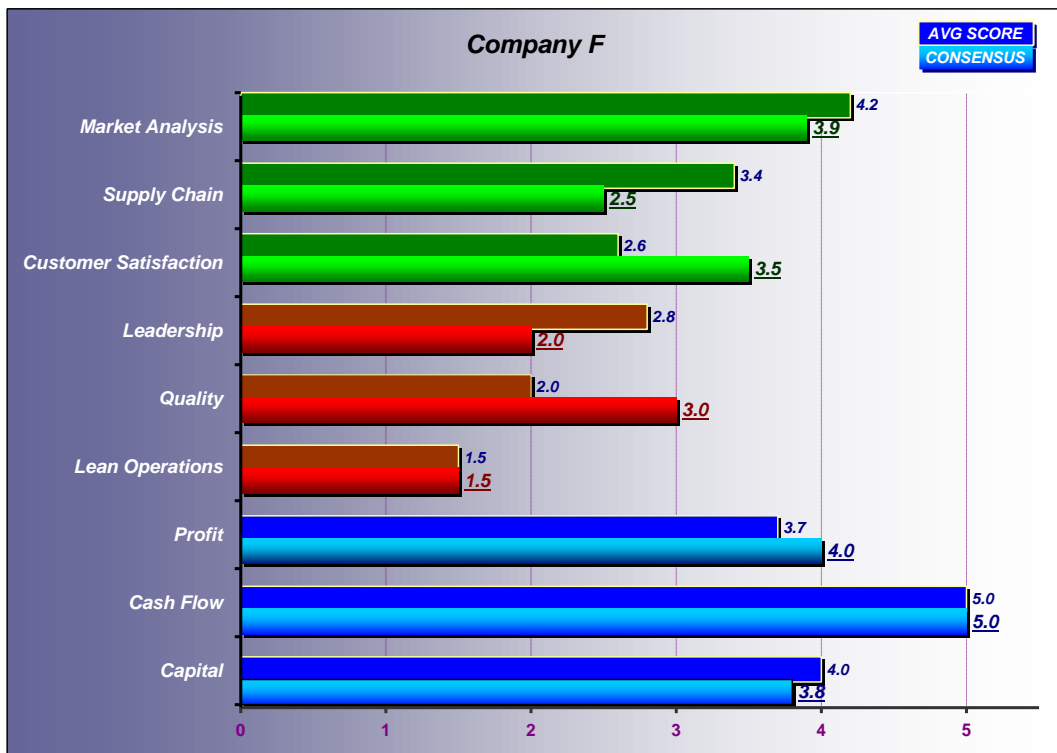
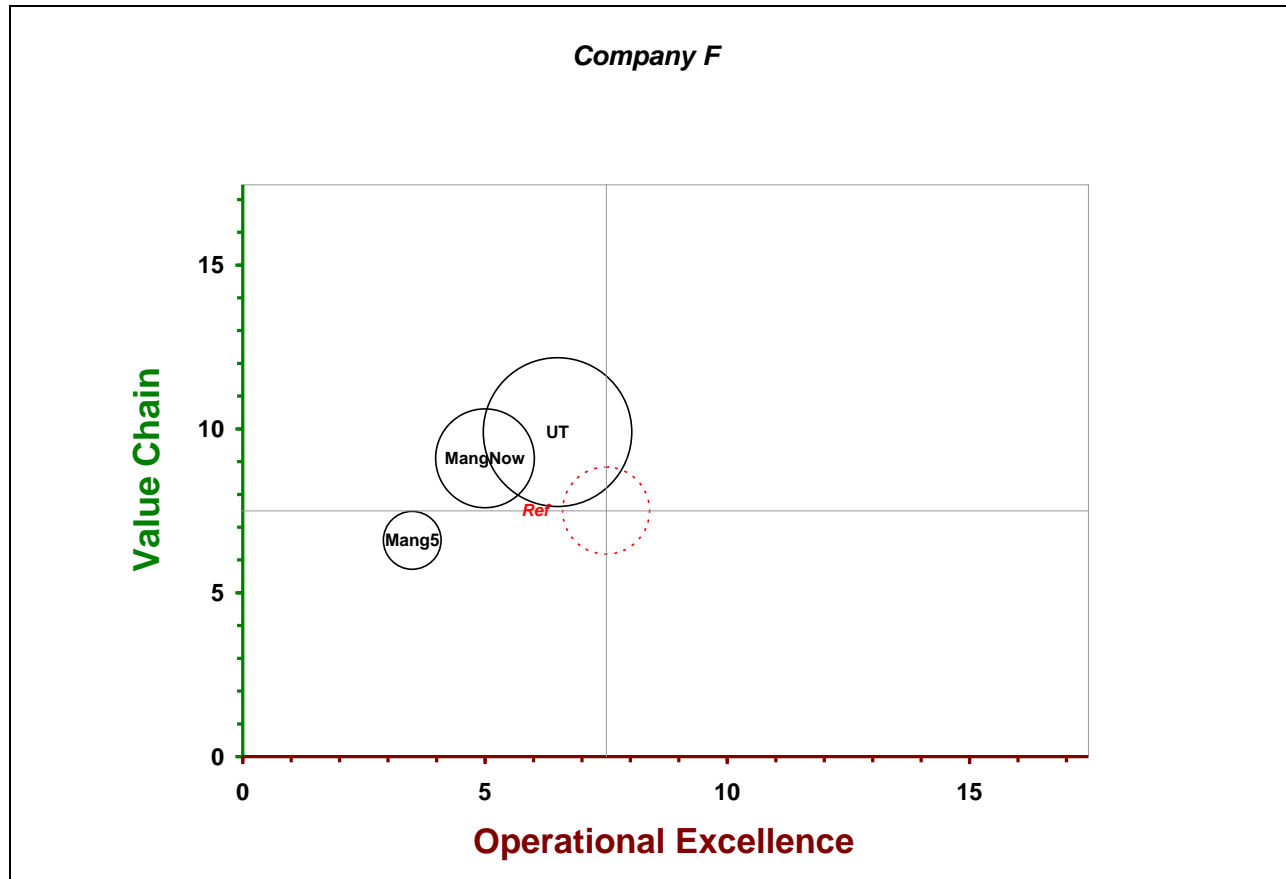


Figure 26. Company F – UT Team’s Evaluation From Consensus (Data Index 5)

Figure 27 provides a graphical comparison of the management team's evaluation of now and five years ago, and the evaluation from the UT team.

The data used in the Company F management charts comes directly from their scores on the 27 items.



**Figure 27. Company F – All RIPA Evaluations  
(Company F Now, Company F Five Years Ago and UT Team)**

#### Qualitative Data

The management team responded to two questions to provide qualitative data. The intent of this questioning was to gather supporting information for 1) the five year previous RIPA input and 2) the present RIPA with verbal insights as to where the company felt they could improve.

*Did you tend to rate yourself higher or lower now versus before?*

- Definitely higher now than five years ago, and way higher than six years ago. We have had restructuring that cut the budget and increased productivity to meet same targets.
- Improvements are attributed to management approach: conservative, better decision making; they still struggle with decisions about growth.
- Have consequences now for not meeting targets.
- Management is conservative because they remember time when company was bleeding financially from overextending on growth.

- Management cut budgets and then increased productivity to meet budget. This made a big difference.

*If there is one thing you'd change to improve performance of your company, what would it be?*

- More mature processes in manufacturing and engineering; still too ad hoc.
- Right mix of new staff to get to new level.
- How to exploit new opportunities.
- Formal LEAN/six sigma programs across the company.

### **Analysis**

Data provided by Company F suggests that they have a solid financial plan and footing. They are conservative with regard to venturing into areas of potential growth as a result of a former company culture of too-rapid expansion and subsequent marginal financial performance. This is evident in our rating of Company F and apparent from their qualitative comments. They are hesitant about rapid growth that could create financial problems, and struggle with investing in new staff and operational methods (lean/six sigma).

Company F has a focus on responding to their customers. Their prime customers are in-the-field technicians, and their equipment is designed to work simply to provide equipment performance data that can be used without requiring operator analysis. As such, the company readily provides field support and warranty work so that the technician customer has confidence and loyalty to their brand.

There was little evidence of Lean and/or six sigma processes in their manufacturing and business operation. Operating statistics were not evident, and admittedly, they perform to ISO 9000 rather than developing a Lean operation. Supporting this observation was management's statement that the one thing they would change to improve performance was implementation of mature processes across the company.

### **Summary of Results**

Figure 27 provides a comparison of all data from the RIPA survey of Company F. This graphic suggests:

- There is agreement on financial viability between the consensus RIPA scores of the UT team and 27 item input method of the management team on the present state.
- There is agreement between the 9 item present and past states and the discussion from management about the company's past to present performance. Both methods indicate better financial performance in the present. Improved leadership is credited with the current stability of the company, as suggested in the management debrief and evidenced in the past and present bubbles.
- All scores suggest below average operational processes. This was supported by both the UT team observations and discussions/RIPA scoring by management.

Company F was the first company visited and served as a pilot for the assessment process. No interviews with employees were done in this interview. One of the assessors had prior knowledge of the company and provided insights to the other team members. After determining the value of this extra information, the employee interviews were added as a mandatory component of the assessment process.

## **APPENDIX J: COMPANY G VISIT SUMMARY**

### **Introduction**

Company G provides specialty materials as a military supplier. They have a limited market with no presently identified commercial applications for their product. Their facility has a full range of special testing services for dynamic and environmental conditions.

Company G is running at only 50 percent utilization and has excellent R&D capability to support their product. They are presently ramping up from a research house to a product supplier of their proprietary technology. They estimate 16 percent of the market share in their product.

Company G is moving from a pure research facility to research and production. They are presently growing their manufacturing capability. They intend to move from 50 percent research/50 percent production to 20 percent research/80 percent production within three years.

Company G is ISO 9001 and AS9004 certified and have an excellent quality assurance program.

### **Interview and Tour Summary**

All employees from the top management to the shop floor workers were excited to talk with us about their product and their company. They have a family atmosphere and take pride in their support of military operations. They have an adequate facility in size, tools and supporting equipment. They have recently invested in new machinery that is intended to take them from a research house to a manufacturing facility.

The senior management have been with the company for many years with the exception of a newly hired manufacturing manager who is a Six Sigma Black Belt. He will also act as the Quality Assurance manager and appears to be starting to implement Six Sigma tools to track their process. They have used a communication and progress tracking system rather than process control.

Company G has excellent product display so each worker knows how important each of their individual jobs are. The shop was neat, but did not appear to have a good process flow. Their shop has a good emphasis on safety and workers stated they really enjoy working there, it's like a family.

### **Management Debrief**

The management team was interviewed regarding 1) how they have changed in the last five years and 2) what they believe to be their biggest challenges and obstacles.

### **Methodology**

The Company G management team evaluated their company in four different ways. Each data set was provided independently by each member of the Company team in paper and pencil mode. The four data sets are:

- Data Index 6: Scoring of the 27 items for present state.
- Data Index 7: Scoring of the company on the nine categories in its present state (1 through 5 scale).
- Data Index 8: Scoring of the company on the 27 items five years ago.
- Data Index 9: Scoring of the company on the nine categories five years ago (one through five scale).

The management team did not discuss their ratings or reach consensus.

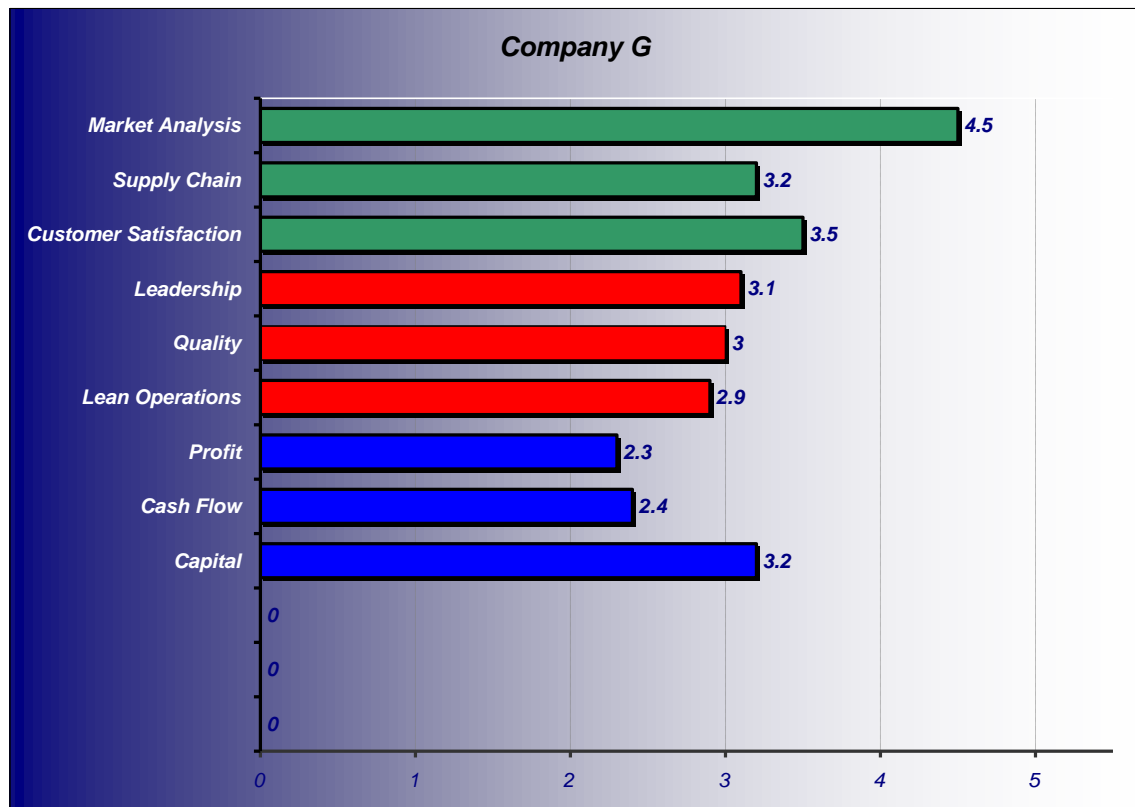
The data was input into the RIPA assessment spreadsheet by the UT team of researchers.

The UT team arrived at their RIPA results by each team member independently answering the 27 items (data index 3) and then reaching consensus as a team on the final score for each of the nine categories (data index 5).

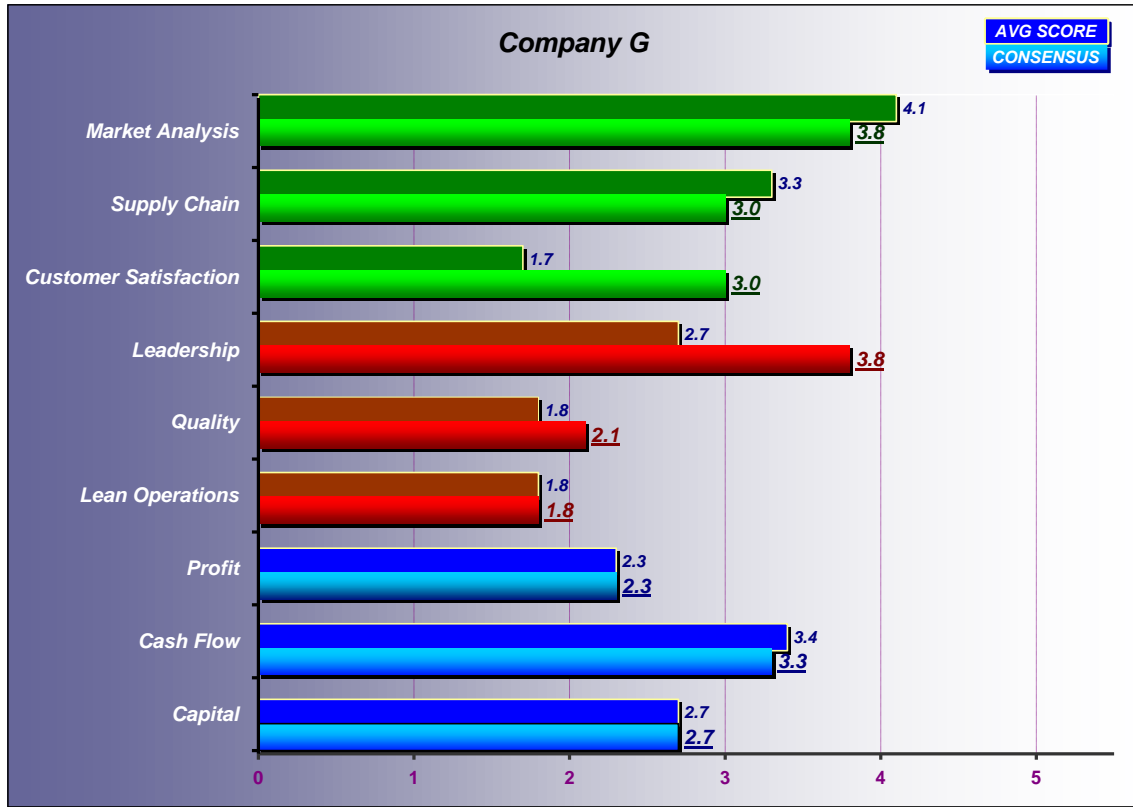
## Data

### RIPA Data

Figure 28 provides the nine item scores as generated by the RIPA calculator for the Company G management team's input of the 27 items. Figure 29 provides the UT team's scores for the nine items as generated by the RIPA calculator of the 27 items and the consensus scores.



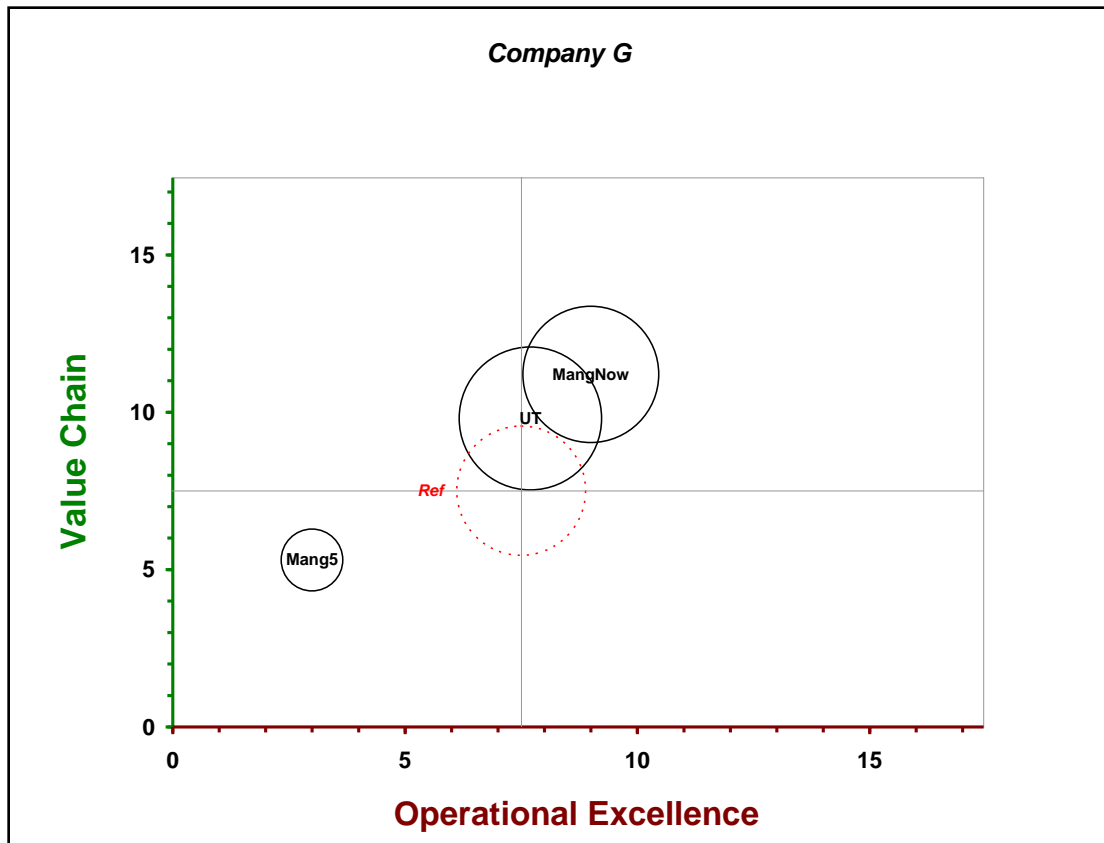
**Figure 28. Company G – Management's Rating From Input of 27 Items (Data Index 10)**



**Figure 29. Company G – UT Team’s Evaluation From Consensus (Data Index 5)**

Figure 30 provides a graphical comparison of the management team’s evaluation of now and five years ago, and the evaluation from the UT team.

Company G managers evaluated their company using the 27 items both now and five years prior. The data used in the Company G management charts comes directly from their scores on the 27 items.



**Figure 30. Company G – All RIPA Evaluations  
(Company G Now, Company G Five Years Ago and UT Team)**

### Qualitative Data

The management team responded to two questions to provide qualitative data. The intent of this questioning was to gather supporting information for 1) the five year previous RIPA input and 2) the present RIPA from a casual dialogue with the Company G management team.

*What has changed over the last five years?*

- Wanted new leadership in the company and we went and found it.
- In the last 18 months we have started putting process controls in place.
- Customer has forced us to mature and move from research facility to also manufacturing.

*What challenges/obstacles face your company?*

- Need for everyone to understand our new culture about what is acceptable.
- Everyone has to learn about process control – know what they need to do and then do it.
- Be consistent in management.

### Summary of Results

- From Figure 28 and Figure 29, Company G's highest scores were in Market Analysis. The UT team rated them the lowest in Lean Operations as they were just starting to implement Lean techniques. Quality is the second lowest rating from the UT team.

- From Figure 28, Management rated themselves the lowest in Profit and Cash Flow, which is interesting considering they would not share financial data with the UT group. Management's third lowest rating was Quality, which trends with the UT rating.
- Company G stated that they had hired new managers in the last two years to help make the shift to a quality, production facility from a research oriented facility. This was evident in their lower score in all categories from five years ago.
- Company G management rated themselves high in Marketing due to their recent work in preparing a marketing/business plan. This plan was not rated quite as highly by the UT team, and contributed to the lower Operational Excellence score by the UT team in Figure 30.



### **APPENDIX K: WEEK 3 – RIPA FIELD WORK, JULY 30 – AUG 3, 2007**

As a part of the validation process and on-going training, a one week training class was conducted for AFRL/RXM *ManTech* personnel. The class agenda is provided as electronic attachment. The course evaluations were very positive and are also provided.

Some key facts about the class were:

a. The purpose for the training:

- To provide a review for prior participants whom had not participated in a RIPA event since their training.
- To provide practice in the RIPA assessment for AFRL/RXM *ManTech* personnel who had either a condensed version of the course or no prior training. In each case, the participants had not previously performed a RIPA assessment.
- To provide data to be used in the validation process.

The learning objectives were as follows;

- Utilize the RIPA as a tool to understand the stability of the company, its progress with lean, the strengths and weaknesses that may affect the probability of success for the technology transition (Module III).
- Understand what type of assessment team should be assembled to do the RIPA, financial analysis, and any other activities deemed necessary (Module III).

The weekly schedule is provided an electronic attachment.

b. Potential user groups who would need this type of training are engineers and program managers with the need to participate in the assessment of the operational, financial and supply chain readiness of a company. Participants will have had little prior training and experience in the topics.

c. Methods and sources used to develop the training. This course was developed for AFRL/RXM *ManTech* was accomplished under a previous contract.

## **Course Feedback**

### **University of Tennessee “Industrial Preparedness RIPA Practice”**

#### **Wright Patterson Air Force Base**

**July 30- August 3, 2007**

#### **1. Did the course content meet your expectations? Please explain.**

Yes, I was expecting to get hands on practical knowledge & experience. Provided more practice. I felt a sense of participation with having participated in earlier training. For me a RIPA refresher.

I don't have any experience in this area and the course gave me some fundamental skills and a tool to complete a valid assessment with confidence in the results.

Yes, I was told the course would help us to better assess a plants manufacturing ability. Wasn't sure what to expect but was a good review & practice of the process of RIPA.

I didn't have any previous training, but I still got a lot out of the course. For the most part, the material was well organized. I was looking for the opportunity to practice the walk through's & pulling information out of the companies representatives.

No...I have taken the class before so there was nothing new. I took the 3wk already. Good info-refresher.

#### **2. Please comment on the application of the course content to your organization.**

Will help me provide a better understanding of RIPA and MRA's to my leadership. We will conduct RIPA on all contracts.

This will help on issues & developing proactive action plan. As we practice the RIPA concepts, I will apply it more to MRA performed on Title III and Mantech Projects.

Very applicable. Regularly engage with new, smaller – size companies and need to assess their condition. Assist me in a rapid assessment of the general ability of a company to implement/manufacture a new technology or end item.

I feel it will be able to help us on our MRA's. We will use it in our MRA process. The RIPA tour questions, evaluation criteria seemed more in depth than I would expect from an MRA.

The content is very valuable for performing MRA's.

Very applicable since our personnel need to be able to perform manufacturing assessments. Will help teaching RIPA/MRA.

I believe there is a disconnect between RIPA and our MRA process. Frankly, I think RIPA is most applicable to Title III programs where I am concerned more about the business aspects than manufacturing.

I think this content is “spot-on” for meeting needs of our org. Great course!

Directly applicable to MRL activities and strengthens our core competencies of industrial readiness & manufacturing readiness. I will use it as I get involved in “Mantech MRA's”.

Needs more “follow on” focus. For instance, why not bring in a “user” of the RIPA tool, who has used it to make a decision for selecting one supplier out of many.

### 3. Were the on-site visits helpful?

17 Yes           No      1 Somewhat

#### Please explain:

It helps to gain experience in asking questions.

I gained the most benefit from applying what I learned with the experience of conducting the RIPA's. Extremely helpful.

Chance to apply what is taught. Provided good spectrum to benchmark.

Helped me to learn what to look for and how to apply the knowledge gained from the course. So many different types of manufacturing methods, plant layouts, and quality programs.

The practice was very helpful.

In order to make an assessment, you need to interact with company personnel. The course would be almost worthless without the site visits/Emphasis on multiple visits to hone RIPA skills! Site visits are a "must".

They all need to be ½ hr to 45 min in conference room and then 1hr or less tour.

Visual examination of how vastly different manufacturing processes employ lean for profitability and operational excellence was enlightening.

### 4. How did the RIPA material add to the course?

Material helped to conduct RIPA. Just right amount of material in the notebook.

New RIPA tools very good addition. Streamlining tool use good.

We need a more "consolidated" handbook as a reference tool.

Vital to understanding/utilizing the tools. Helped with our assessments.

Interesting, but somewhat confusing when trying to think of an MRA. Especially the ratio information.

Provided Industrial preparedness assessment training. It was good to go through financial definitions again.

Perfect. Gave me the calculations and formulas to apply.

Sufficient and useful.

### 5. Please rate the overall service of the Center for Executive Education including coordination and customer support.

11 Excellent    7 Good         Fair         Poor

#### Comments:

Good coordination & customer support.

The instructors encourage interaction within the team structure.

**6. Please rate AFIT conference room experience.**

  5   Excellent     12  Good      2  Fair         Poor

**7. Please rate your satisfaction with the faculty. Please circle your choice.**

(1=low; 5=high)

Instructor	Instructor's contribution to what was learned in class	Instructor's preparation, organization, and ability to communicate ideas	Instructor's use of class time
Alan Pannell	<b>4.65</b>	<b>4.76</b>	<b>4.71</b>
Elaine Seat	<b>4.41</b>	<b>4.71</b>	<b>4.59</b>

**9. Would you recommend this program to a colleague?**

  17  YES        1  NO

**10. Additional Comments:**

More control over tours and suppliers visits.

Kudos for working to keep our folks focused on asking correct questions – breaking out of their propensity to drill deep on technical issues.